NUCLEAR SCIENCE ABSTRACTS

Vol. 8, No. 16, August 31, 1954

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ERRATA

BIOLOGY AND MEDICINE

4852

Atomic Energy Project, Univ. of Rochester
CONCENTRATION OF LEUKOCYTES FROM SMALL
SAMPLES OF BLOOD BY CENTRIFUGATION IN PLASTIC
TUBING. M. Ingram, G. Yettewich, and A. Struthers.
June 16, 1954. 10p. Contract W-7401-eng-49. (UR-333)

A method for preparing concentrations of intact, viable
leukocytes with unaltered differential leukocyte counts from
small samples of whole blood is described. The procedure
has been successfully applied to determining the differential
WBC count in leukopenic animals, to examination of large
numbers of leukocytes in phagocytosis studies, and in
determining the incidence of unusual cell types likely to be
encountered only rarely. (auth)

AEROSOLS

4853

PROTECTION AGAINST RADIOACTIVE DUSTS BY MEANS
OF DEVICES OF THE AEROJET VENTURI TYPE. (La
Protection Contre Les Aérosols de Poussières Radio-
Actives Par Les Appareils Du Type Aérojet-Venturi).
Translated by J. Hensoldt from an undated and unidentified
manuscript, June 13, 1952. 34p. (ONI-tr-1102)

The protection against radioactive dusts afforded by
devices of the aerojet venturi type is evaluated. (C.H.)

RADIATION EFFECTS

4854

Fission Products Lab., [Engineering Research Inst.], Univ.
of Mich.
NUCLEAR ACTIVATION WITH COBALT-60 GAMMA RAYS.
W. Wayne Meinke. May 1954. 16p. Contracts AT(11-1)-
70 and AT(11-1)-162. (AECU-2904)

Twenty-four elements that occur in foods have been
tested for induced activity after irradiation in a multi-
kilocurie source of Co^{60}. No activity detectable with a
scintillation well counter was observed. (auth)

4855

Brookhaven National Lab.
MUTATION IN DROSOPHILA MELANOGASTER MALES
EXPOSED TO β-RADIATION FROM NEUTRON ACTIVATED
PHOSPHORUS-BAKELITE PLAQUES. R. C. King. [1954]
21p. (BNL-1849)

The x-ray induced recessive lethal mutation rate in
Drosophila melanogaster has been found to be the same
whether or not X-chromosomes are modified by the attach-
ment of fragments of the Y-chromosome. Beta rays from
neutron-activated, phosphorus-bakelite plaques are found
to be 60% as efficient as 90-kv x rays in producing sex-
linked recessive lethal mutations. This difference is
attributed to differences in the distribution of ionization
produced in tissue by the two classes of radiation. Re-
calculation of earlier data leads to the conclusion that the
experimental and calculated values for the fraction of the
total P^{32} β-particle energy absorbed by the gonad of P^{32}-

labeled Drosophila males are not in disagreement as was
previously thought. (auth)

4856

Hanford Works
BIOLOGY RESEARCH — ANNUAL REPORT [FOR] 1953.
Jan. 4, 1954. 163p. Contract W-31-109-Eng-52. (HW-
30437)

Separate abstracts have been prepared on two sections of
this report. (For preceding period see HW-28636.)

4857

Hanford Works
[PAGES 7-94 OF] ANNUAL REPORT [ON] BIOLOGY
RESEARCH [FOR] 1953. Jan. 4, 1954. 88p. Contract
W-31-109-Eng-52. (HW-30437(p.7-94))

Radiobiological conditions in the Columbia River during
1953 are compared with conditions during previous years
and current studies are summarized. Data are presented
from studies of the following: the effect of reactor effluent
on young salmon and trout, and on cereal plants; the uptake
of Pu^{239} and Ce^{144} by plants; the physical and chemical
properties of soils for use in comparative studies of fission
product uptake by plants; the radiosensitivity of vitamins;
design of a turbidimeter which automatically records the
turbidities of bacterial cultures during growth; the
mutagenic effects of P^{32} in Neurospora; the effects of tritium
oxide on some synthetic processes in Chlorella; the distribu-
tion of bound tritium in the rat following exposure to
tritium gas and to tritium oxide. (C.H.)

4858

Hanford Works
[PAGES 95-163 OF] ANNUAL REPORT [ON] BIOLOGY
RESEARCH [FOR] 1953. Jan. 4, 1954. 75p. Contract
W-31-109-Eng-52. (HW-30437(p.95-163))

Data are presented from tracer studies of the absorption
and distribution of Ru in fowl; the normal abundance of Ra
in cadavers; the percutaneous and gastrointestinal absorp-
tion of Pu in rats; the effectiveness of various therapeutic
agents in Pu poisoning; determination of α particle emitters
in the lung; and the toxicity of I^{131} in sheep and rabbits.
(C.H.)

4859

School of Aviation Medicine
BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADI-
ATION. (A PRELIMINARY INVESTIGATION). SEQUELAE
FOLLOWING APPLICATION OF HIGH-INTENSITY X-
RADIATION TO THE HEAD OF RABBITS. (PROJECT NO.
21-3501-0005, REPORT NO. 15). Herbert B. Gerstner,
John E. Pickering, and Alois J. Dugi. May 1954. 8p. (NP-
5222)

The heads of 28 rabbits were exposed to high-intensity
x radiation; the total dose delivered to the brain was 12,500
r (12.5 kr) ± 1,500 r. In the sequelae, developing rapidly
after exposure, several distinct phases could be recognized:
latent or prodromal period (mean duration, 29 minutes);
convulsive phase (approximate duration, 2 hours); somnolent
phase (approximate duration, 3 hours); ataxic phase (dura-
tion, until death); and death (mean survival time, 2.5 days).
The most outstanding features of the convulsive phase were
repeated epileptoid seizures, whereas, the characteristic

symptoms of the atoxic phase were severe disturbances of posture, equilibrium, and movement. (auth)

4860

Atomic Energy Project, Univ. of Calif., Los Angeles
EFFECT OF X-IRRADIATION ON GASTRIC SECRETION AND THE ACCOMPANYING GROSS AND HISTOLOGICAL CHANGES IN THE "SHAY" RAT STOMACH. Lawrence E. Detrick, Harvey C. Upham, Dorothy Highby, Virginia Debley, and Thomas J. Haley. July 2, 1954. 19p. Contract AT-04-1-GEN-12. (UCLA-298)

Pre-irradiation of rats subjected to pyloric ligation resulted in a great variation in response. Effects on pepsin-HCl activity are described, and results compared to changes resulting from irradiation alone. Irradiation alone reduced the lytic effect on the epithelium of the rumen, but the accompanying vascular effect was equally as severe as that seen in rats subjected in the procedure are described by Shay. In both the irradiated and the irradiated-ligated rats, lesions in the stomach body were characterized by single terminal vascular tuft engorgements that coalesced into focal engorged vascular networks with or without hemorrhagic ulcerations. Such lesions were absent in the "Shay" rat preparation. (auth)

4861

Atomic Energy Project, Univ. of Rochester
THE EFFECTS OF X-RADIATION ON THE METABOLISM OF BAKERS' YEAST. William J. Bair. May 26, 1954. 254p. Contract W-7401-eng-49. (UR-321)

The results of an investigation of the effects of 90,000 r, 250-kv x rays on bakers' yeast are presented. It was demonstrated that the nature of the observed effect on respiration and fermentation of glucose, after a dose sufficient to inhibit colony formation in over 90% of the cells, is dependent upon the presence of potassium and the pH of the buffer system while the measurements are being made. The 30% inhibition observed at pH 4.5 in potassium-free buffer is completely reversed by the presence of potassium. At pH 6.5 a 15% stimulation is replaced by a 10 to 15% inhibition when potassium is added. Inhibition at both pH levels can be considerably enhanced by post-irradiation treatment of the yeast with a cation exchange resin. Starvation likewise increases the apparent effect of irradiation on both respiration and fermentation. Inhibitions of 50% are common in potassium- and phosphate-free buffer. These effects can be increased still further by treating the yeast with an ion exchange resin and as much as 90% inhibition of fermentation is observed in such yeast after 90,000 r. Pre-irradiation treatment with the resin has much less effect. These facts indicate a possible method for revealing radiation damage to metabolic processes ordinarily considered insensitive or not measured in earlier experiments. They further suggest an effect of irradiation on the active transport of cations by the cell. Data are presented which show that the endogenous metabolism is altered very little by these x-ray doses. The inhibitory effects of radiation on exogenous metabolism are not increased by growing yeast in nitrogen- or sulfur-deficient media and metabolism of substrates other than glucose is less sensitive in general. In other experiments there was no marked effect of radiation on acid phosphatase activity. The data are discussed in part from the point of view of mechanism and it is concluded that at least two types of metabolic changes occur. Also, growth experiments suggest two effects of radiation: a permanent inhibition and a temporary inhibition of cell division. (auth)

4862

INDEPENDENT X-RAY EFFECTS ON CHROMOSOME BREAKAGE AND REUNION. Sheldon Wolff and K. C. Atwood (Oak Ridge National Lab., Tenn.). Proc. Natl. Acad. Sci. U. S. 40, 187-92(1954) Mar.

Some effects of x-ray dose fractionation on two-hit chromosome aberrations in root tips of Vicia faba have been studied with and without the protective agent, BAL. The data are consistent with the following conclusions: the time interval between breakage and reunion is dose dependent and is decreased if BAL is present during irradiation; breaks produced in the presence of BAL interact normally with those produced in its absence; rejoining of breaks produced in the presence of BAL is delayed by previous irradiation in its absence; BAL decreases the aberration yield and the reunion delay by different amounts; and the reunion delay time has little or no influence on the aberration frequency. Taken together, the findings indicate that chromosome breakage and the radiation-induced delay of reunion are different and independent effects of the radiation. (auth)

4863

INDUCED POLLEN LETHALS FROM SEEDS OF DATURA STRAMONIUM EXPOSED TO RADIATION FROM A NUCLEAR DETONATION. J. L. Spencer (Univ. of Massachusetts, Cambridge) and A. F. Blakeslee (Smith Coll., Northampton, Mass.). Proc. Natl. Acad. Sci. U. S. 40, 441-6(1954) June.

The relative effectiveness of fast neutrons from a nuclear detonation appeared to be about 13 or 14 times that of either gamma rays or x rays when mutation rates based on pollen lethals in Datura were compared. (auth)

4864

THE EFFECTS OF FAST-NEUTRON RADIATION FROM A NUCLEAR DETONATION ON CHROMOSOME ABERRATION IN DATURA. Henry T. Yost, Jr. (Amherst Coll., Mass.), Jean Cummings (Western Reserve Univ., Cleveland, Ohio), and A. F. Blakeslee (Smith Coll., Northampton, Mass.). Proc. Natl. Acad. Sci. U. S. 40, 447-51(1954) June.

Seeds of Datura were exposed to the fast neutrons from the explosion of a nuclear device. Data have been obtained from this material which indicate that the relative biological efficiency of fast neutrons to gamma or x rays is about 14. The types of aberration and the number of aberrations per affected cell are the same for neutrons, x rays, and gamma rays. No new or unusual types of biological change were observed as the result of the exposure to the extremely high intensity of the radiation from the explosion. (auth)

4865

EFFECT OF PHOSPHORUS-32 ON GROWTH AND VIABILITY OF RAT EMBRYOS. Melvin R. Sikov and Thomas R. Noonan (Univ. of Rochester, N. Y.). Federation Proc. 13, 453(1954) Mar.

Results are summarized from a study of the effects of various doses of intraperitoneally injected P^{32} solutions on the growth and viability of rat embryos. (C.H.)

4866

DAMAGE TO POSTERITY CAUSED BY IRRADIATION OF THE GONADS. H. J. Muller (Indiana Univ., Bloomington). Am. J. Obstet. Gynecol. 67, 467-83(1954) Mar.

The damage to future generations resulting from irradiation of the gonads, and the amount of damage caused by a given dose of radiation are discussed. Data from genetic studies on Drosophila and on mice are reviewed and are applied in predictions concerning damage to posterity. (C. H.)

4867

MUTATION RATES AT SPECIFIC AUTOSOMAL LOCI IN THE MATURE AND IMMATURE GERM CELLS OF DROSOPHILA MELANOGASTER. Mary L. Alexander (Univ. of Texas, Austin, and Oak Ridge National Lab., Tenn.). Genetics 39, 409-28(1954) May.

Mutation rates were obtained for 8 specific loci on the third chromosome of Drosophila melanogaster. With a dose of 3000 r of x radiation, the rates for mature sperm

varied from $2.7 \times 10^{-8}/r$ for the thread locus to $8.75 \times 10^{-8}/r$ for the peach and ebony loci. The 8 loci gave an average rate of $5.98 \times 10^{-8}/r/locus$. Of the 58 x-ray-induced mutations, 20 were viable, 35 were lethal, and 3 were semilethal when homozygous. Spermatogonial cells in larvae 20 to 22 hours old were irradiated with 900 r of x radiation. Single mutant individuals and clusters of the same mutation were recovered from adult males which had been treated as larvae. A variation in the size of the clusters indicated that the number of spermatogonia under test varied from 7 to more than 100. The spermatogonial mutation rate is estimated to be approximately $1.52 \times 10^{-8}/r/locus$. Four spermatogonial mutants were viable, 3 lethal and 1 semilethal in the homozygous condition. A lower average mutation rate obtained for spermatogonia than for sperm can be better explained by a differential genetic sensitivity of the 2 stages than by germinal selection. (auth)

4868

MECHANISM OF RADIATION ANENCEPHALY, ANOPHTHALMIA, AND PITUITARY ANOMALIES. REPAIR IN THE MAMMALIAN EMBRYO. Samuel P. Hicks (New England Deaconess Hospital, Boston, Mass.). Arch. Pathol. 57. 363-78(1954) May.

A procedure is described for irradiating the pregnant animal on a certain estimated day of gestation, removing some embryos four hours later, and removing the remaining fetuses at one or more subsequent times. This method provides a much closer approximation of the average age of the litter of embryos, the sites of radiation injury, and the resultant malformation, all in one litter. These demonstrate that despite extensive necrosis of differentiating neural cells and cells in an analogous stage in other developing systems, complete or nearly complete repair can occur in many zones. Radiation malformations are therefore the result of a balance between radiation damage and the capacity to repair in any given anlage or developing zone. In the presomite to first somites stage (ninth day), differentiating cells in the neural plate and mesenchyme are destroyed by radiation and anencephaly and anophthalmia results. Paradoxically on the 10th day (three to eight somites) malformation is essentially limited to the eyes; yet radionecrosis in the embryo is very severe in the neural folds, neural tube and groove, somites, and condensing areas of mesenchyme. Virtually only the optic pits fail to recover. Repair is from the primitive mitotic cells, such as neurectoderm and some primitive mesenchyme cells, which are relatively radioresistant. Some of the possible underlying reasons for the malformative patterns and future lines of investigation are also discussed. (auth)

4869

RELATIVE BACTERICIDAL EFFICIENCIES OF THREE TYPES OF HIGH-ENERGY IONIZING RADIATIONS. S. A. Goldblith, B. E. Proctor, S. Davison, B. Kan, C. J. Bates, E. M. Oberle, M. Karel, and D. A. Long (Massachusetts Inst. of Tech., Cambridge). Food Research 18, 659-77 (1953).

The effect of nonuniform ionization density of radiations such as are obtained when cathode rays are absorbed in matter has been derived theoretically, and the theoretical derivation has been substantiated experimentally for both a sporulating and a nonsporulating bacterial organism. A volume effect was found on exposure of E. coli to the Co^{60} gamma rays. This volume effect was not found with spores of B. thermoacidurans. With both these test organisms, if the samples were sufficiently thin (0.1 cm. or less), high-energy cathode rays and x rays from the particle accelerator and high-energy gamma rays from the Co^{60} source all had essentially the same relative bactericidal effectiveness,

within a very few per cent. If, however, the thickness of the samples was such that the variation in ionization from top to bottom of the samples was 40%, the relative bactericidal efficiency of the cathode rays was less than that of the gamma rays or the x rays by a factor of 6:10 approximately. This fact is of importance from the standpoint of practical processing, for in the processing of foods it is unlikely that thin samples will be available for most operations. On the contrary, it is expected that it will be necessary for ionizing radiations to penetrate thick samples. For this reason it would appear that, under conditions of equal absorption of energy, the relative bactericidal effectiveness of high-energy cathode rays would be less than that of gamma rays or of x rays. (auth)

4870

THE MANNER OF DEPENDENCE OF THE "PERMISSIBLE DOSE" OF RADIATION ON THE AMOUNT OF GENETIC DAMAGE. H. J. Muller (Indiana Univ., Bloomington). Acta Radiol. 41, 5-20(1954) Jan.

Investigations by Russell in mice show that a dose of 80 r induces 1 mutation in a given gene in 50,000 gametes. If the same mutation rate applies to humans, it would probably result in a doubling of the spontaneous production of mutations, and if continued indefinitely, it would cause "genetic death" of 2 persons in 5. It would also result in a 40% (instead of the usual 20%) reduction in the fitness of the average individual. If such a situation persisted indefinitely, the result would be a continued genetic deterioration and/or a continued decline in numbers. As a provisional measure it seems advisable to limit the average per capita dose received before reproduction to about 20 r, that is to a dose which causes 25% of the spontaneous mutation rate. (auth)

4871

AN ANALYSIS OF THE CHANGING RADIATION RESPONSE OF THE DEVELOPING MOUSE EMBRYO. Liane Branch Russell and W. L. Russell (Oak Ridge National Lab., Tenn.). J. Cellular Comp. Physiol. 43, Supplement 1, 103-49 (1954) May 1.

A survey and discussion are presented of the general results of a number of experiments in which several thousand genetically controlled mouse embryos were irradiated with doses ranging from 25 to 400 r and at stages of development ranging, by 24-hour intervals, from day $\frac{1}{2}$ to day $13\frac{1}{2}$ postconception. (auth)

RADIATION HAZARDS AND PROTECTION

4872

RAND Corp.
RESIDUAL GAMMA RADIATION HAZARD AFTER LIMITED DECONTAMINATION OPERATIONS. F. J. Krieger. Apr. 1, 1954. 18p. (RM-1226(RAND))

Calculations are presented which are used in computing the reduction in γ radiation level at any point one meter above a previously contaminated area which has been either completely or 80% decontaminated. The geometrical configurations considered are a circle of variable radius and an infinitely long strip of variable width. (C.H.)

RADIOTHERAPY

4873

Washington Univ., Seattle. School of Medicine
THE USE OF GAMMA RAYS AS THERAPEUTIC AGENT IN CARCINOMA. FINAL REPORT. [1953]. 15p. Contract [AT(11-1)-85]. (AECU-2905)

Several hundred patients with cancer of the cervix were treated by two different methods. One group was treated with x rays and radium. In the other group, the parametrium was treated with radiogold, injected transvaginally, and the cervix was treated either by radium or by hysterectomy, or by both radium and hysterectomy. In all operated patients

a fairly extensive pelvic lymphadenectomy was done at the time of the hysterectomy. Results of the two treatments are compared. (auth)

TOXICOLOGY STUDIES

4874

MICROSCOPIC OBSERVATIONS CORRELATING TOXICITY OF BERYLLIUM OXIDE WITH CRYSTAL STRUCTURE. G. C. Crossmon and W. C. Vandemark (Bausch and Lomb Optical Co., Rochester, N. Y.). Arch. Ind. Hyg. and Occupational Med. 9, 481-7(1954) June.

Four samples of beryllium oxide designated as G. C. and S. P. refractory grades, fluorescent grade, and special grade were examined microscopically by use of the polarizing microscope and dispersion staining to determine whether or not the four samples showed differences in toxicity. It was observed that the refractory grades were identical in birefringence and refractive index, consisting only of double refracting particles having indices of approximately 1.72 for the ordinary ray and 1.73 for the extraordinary ray. The fluorescent grade contained many particles which appeared to be identical to the refractory grades both in indices and in birefringence but were smaller and rod-shaped. Also present in a somewhat higher percentage were particles having a slightly lower index. The special grade contained none of the particles observed in either the refractory grades or the fluorescent grade; all particles had much lower indices and were for the most part single refracting. Apparently beryllium oxide, dependent on the method of manufacture, can exist in several stable forms differing in refractive index, birefringence, and toxicity, the lower index material with little or no birefringence being the most toxic. (auth)

TRACER APPLICATIONS

4875

Boyce Thompson Institute for Plant Research, Inc.
THE USE OF RADIOISOTOPES IN STUDING THE AFFINITY OF VARIOUS TOXICANTS FOR FUNGUS SPORES. Lawrence P. Miller, S. E. A. McCallan, and Richard M. Weed. [Apr. 19, 1954]. 15p. Contract [AT(30-1)-788]. (AECU-2896)

When fungus spores are exposed to dilute solutions of toxicants such as 2-heptadecyl-2-imidazoline, 2,3-dichloro-1,4-naphthoquinone, silver, mercury, or cerium, relatively large amounts are taken up rapidly by the spores. The amount of toxicant taken up depends upon the toxicant and the particular species involved. When various materials not closely related chemically are used in either consecutive or simultaneous applications to fungus spores interferences are not apparent. Spores saturated with one toxicant will readily take up large amounts of a second unrelated chemical. Competition for receptor sites was found between Ag^+, Hg^+, Hg^{++}, and Cu^{++}. Spores pretreated with Ag take up mercury more rapidly than spores not pretreated. Silver taken up by spores is exchanged more readily than any of the other fungicides studied. It appears that 2,3-dichloro-1,4-naphthoquinone is rapidly changed chemically when taken up by spores, since no exchange occurs when spores apparently saturated with this fungicide are exposed to additional quantities of the toxicant. (auth)

4876

Brookhaven National Lab.
METABOLIC EFFECTS OF MARKED SODIUM RESTRICTION IN HYPERTENSIVE PATIENTS. PART 2. EVIDENCE FOR A VARIABLE SODIUM POOL WITH CONSTANT DIETARY INTAKE. Lewis K. Dahl, Bernard G. Stall, III, and George C. Cotzias. Brookhaven National Lab. and Rockefeller Inst. for Medical Research Hospital, New York. [1954] 15p. (BNL-1843)

Measurements of total exchangeable Na (TENa) were made in a series of 16 patients with essential hypertension before and after marked sodium restriction. Changes in values for TENa have been compared with the net sodium balance according to estimates of intake and output of this ion. In 16 of the 44 periods included in this study, it was found that variation in TENa bore no apparent relationship to net balance calculations and, in fact, diverged significantly. It was suggested that changes in the availability of the reservoir of sodium in bone, and possibly in other tissues, accounted for the findings. (cf. BNL-1738.) (auth)

4877

Atomic Energy Project, Univ of Rochester
IN VIVO LOCALIZATION OF RAT ORGAN ANTIBODIES IN OVARIES, ADRENALS, AND OTHER TISSUES. W. F. Bale and I. L. Spar. June 7, 1954. 28p. Contract W-7401-eng-49. (UR-264)

The localization of thirteen rat organs and tissues was measured following intravenous injection of I^{131}-labeled antibodies against various rat organs. The antibodies were produced by injection of rat organ homogenates into rabbits and subsequent isolation and iodination of a serum gamma globulin fraction. Antibodies against rat kidney localized strongly in adrenal and ovary as well as in kidney. Rat ovary antibodies localized strongly in adrenal and ovary, and to a lesser degree in spleen and kideny. Antibodies against the Walker carcinoma 256 injected into normal rats localized preferentially in spleen, ovaries, and adrenals. Antibodies against lymphatic tissue were relatively nonspecific, but again some tendency is shown for localization in adrenal and spleen. I^{131}-labeled normal gamma globulin reached a higher concentration in rat skin than in other tissues measured, with the exception of blood. The results are discussed in terms of the hypothesis of an autoantibody factor for certain types of disease and with regard to antibodies as carriers of radioactive or high neutron cross section isotopes for therapeutic purposes. (auth)

CHEMISTRY

4878

Cryogenic Lab., Ohio State Univ.
KINETICS, THERMODYNAMICS, PHYSICAL, CHEMICAL PROPERTIES, AND MANUFACTURE OF AMMONIA. [A BIBLIOGRAPHY COVERING THE PERIOD 1900-1951]. Travis Phillips, David White, and H. L. Johnston. Aug. 31, 1952. 176p. Contract W33-038-ac-17721. (AD-8216)

This report contains a bibliography of 2010 references on the physical and chemical properties of ammonia and its manufacture which is subdivided according to subject. The manufacture of ammonia is limited to the direct synthesis from its elements. (auth)

4879

Massachusetts Inst. of Tech.
[STABILITY AND REACTION STUDIES OF HYDROGEN PEROXIDE]. REPORT NO. 42. HYDROGEN PEROXIDE. PART 1. (CHAPTERS 1-4). W. C. Schumb. C. N. Satterfield, and R. L. Wentworth. 253p. Contract N5ori-07819. (AD-17897)

An extensive literature survey was made on the historical development, formation, and manufacturing of H_2O_2 and other peroxide compounds. Methods for concentrating, purifying, and handling peroxides are discussed as well as structural materials for shipping and storage of concentrated products. General views of some equipment employed in the manufacturing and shipping of products are presented. (auth)

4880

Pennsylvania State Coll.

THERMODYNAMIC PROPERTIES OF BORON AND ALUMINUM COMPOUNDS. PROGRESS REPORT NO. 2 [FOR] JANUARY 1, 1953 TO SEPTEMBER 30, 1953. Thomas Wartik, Milton J. Linevsky, and Herbert Bowkley. Oct. 29, 1953. 53p. Contract AF 18(600)-311. (AD-19456)

Investigations were made of the thermodynamic and spectroscopic properties of B_2Cl_4. The heat capacities were measured from 13.42 to 214.51°K, and the Raman and infrared spectra were determined. The heat of fusion and vapor pressures from 227.93 to 272.94°K were also measured, and the thermodynamic entropy was calculated. The heat of fusion was found to be 2579 ± 4 cal mol. The melting point was calculated to be 179.84°K, and the purity of the B_2Cl_4 sample was estimated to be 99.24 mol-%. From the vibrational spectra and the low-temperature heat capacities, the heat capacities of solid B_2Cl_4 from 15 to 170°K were calculated and found to be in agreement with the observed values. (ASTIA)

4881

Northwestern Univ.

AN INVESTIGATION OF THE SOLUTION CHEMISTRY OF RUTHENIUM IN ITS LOWER VALENCE STATES. FINAL REPORT. Donald D. DeFord, William G. Hime, Claude A. Lucchesi, and Hans Horn. May 1954. 30p. Contract AT(11-1)-89. (AECU-2887)

Dry and wet chlorination of Ru metal for the preparation of the chlorides was investigated. A method for the analysis of $K_2Ru(OH)Cl_5$ is outlined. The absorption spectra of solutions of $K_2Ru(OH)Cl_5$ and $(NH_4)_2Ru(OH)Cl_5$ indicate that the solutions contain $[Ru(OH)Cl_5]^{--}$ ions and are characterized by absorption maxima at 370 mμ and 485 mμ. Polarographic studies were made of Ru(III) and Ru(IV) in HCl solution using the droping Hg electrode. (auth)

4882

Kansas Univ.

THE THERMODYNAMIC PROPERTIES AND EQUILIBRIUM PRESSURES IN THE MOLYBDENUM−BORON SYSTEM. Paul W. Gilles and Bernard D. Pollock. [1953] 29p. Contract [AT-(11-1)-83]. (AECU-2894)

In the molybdenum−boron system there are four compounds, or homogeneity ranges, and six crystal structures, Mo_2B, Mo_3B_2, α $MoB_{1\pm x}$, β $MoB_{1\pm x}$, α $MoB_{2.25\pm y}$, and β $MoB_{2.25\pm y}$. From a study of the vapor pressures of these compounds and their mixtures by the Langmuir technique, their stabilities, heats of formation, and the partial pressures of the elements in equilibrium with the solid phases were determined. Values of ΔH^0_{298}, the heats of formation of the compounds, were calculated from the vapor pressures on the assumption that ΔS and ΔC_p for solid reactions are both zero. These values, with the heats of sublimation of Mo and B of $\Delta H^0_{298} = 155.94$ and 140.9, the published free energy functions of Mo and B, and the above assumption, may be used to calculate the high-temperature behavior of this system. The partial pressures of the monatomic elements at 2200°K in equilibrium with one or two solid phases having the over-all composition indicated are given. It is shown that solid compositions having more B than Mo_2B rapidly lose B preferentially. Furthermore, in Langmuir or Knudsen experiments, Mo_2B loses B more rapidly than one-half the rate of Mo loss, so that in such experiments Mo(s) appears, and there is no constant subliming composition. In a closed system, however, Mo_2B would evaporate to give a gas having the same composition. It is demonstrated that there are no gaseous molecules of any importance in the Mo−B system at high temperature. (auth)

4883

[Wayne Univ.]

REACTIONS OF HAFNIUM TETRAMANDELATE. P. T. Joseph. [1954?] 6p. Contract [AT(11-1)-213]. (AECU-2911)

Potentiometric and titrimetric studies of the reaction of $Hf(Ma)_4$ with NH_4OH, ethylenediamine, and diethylamine indicated that it contains 4 equivalents of replaceable H, thought to be from the OH groups present in the inner complex salt. An enhanced acidity of the weakly acidic alcoholic (OH) group of mandelic acid was possible through coordination of Hf with the O atom of the OH group which rendered the H atom more mobile and more acidic. The inner salt behaved as an acid towards an alkali. (J.A.G.)

4884

Wayne Univ.

STUDIES OF ZIRCONIUM TETRAMANDELATE. Richard B. Hahn and Leon Weber. [1954?]. 9p. Contract [AT(11-1)-213]. (AECU-2917)

Various reactions and titrations indicated that Zr tetramandelate must be a chelate-type compound. The reaction of NH_3 with an excess of Zr tetramandelate was formulated as $H_4Zr(C_8H_7O_3)_4 + 3\ NH_4OH \rightarrow (NH_4)_3HZr(C_8H_7O_3)_4 + 3\ H_2O$. When an excess of NH_3 was added, the tetrabasic salt $(NH_4)_4Zr(C_8H_7O_3)_4$ was also formed. The reaction is not stoichiometric. With other weak bases and basic salts, e.g., Na_2CO_3, corresponding reactions took place. With strong bases hydrolysis took place, and $Zr(OH)_4$ was precipitated. (J.A.G.)

4885

Brookhaven National Lab.

FILTRATION, DIFFUSION AND MOLECULAR SIEVING THROUGH POROUS CELLULOSE MEMBRANES. Eugene M. Renkin. [1953] 37p. (BNL-1873)

The theory of filtration and diffusion through porous membranes of Pappenheimer et al. has been verified by direct measurement of the diffusion and ultrafiltration of tritium-labeled water and aqueous solutions of urea, glucose, antipyrine, sucrose, raffinose and hemoglobin through cellulose membranes. Equations are presented relating restriction to molecular diffusion and molecular sieving during ultrafiltration to the total cross-sectional area, length and radius of the membrane pores, and to the radii of the diffusible molecules. Pore radii estimated by the membrane calibration method of Elford and Ferry are shown to be much too small, and a new method of calibration is proposed in which total cross-sectional pore area is measured directly by diffusion of isotope-labeled water. (auth)

4886

Food Machinery and Chemical Corp.

PREPARATION OF NO-NO₂ MIXTURES FROM THE FMC NITROGEN FIXATION FURNACE. SUMMARY REPORT. H. B. Wellman, Ben Davies, E. A. Engler, D. I. Weller, and W. N. Lindsay. Feb. 1953. 50p. (CR-CH-2029; AD-15089)

4887

Pennsylvania State Univ.

FORMATION CONSTANTS OF SOME METAL DERIVATIVES OF COMPOUNDS CONTAINING SULFUR. (PRELIMINARY REPORT). Roger J. Irving. May 1954. 10p. Contract AT(30-1)-907. (NYO-3638) •

A survey study of several sulfur containing compounds has been made to determine which are suitable for potentiometric studies to permit the calculation of formation constants. Formation constants are reported for the compounds $C_2H_5SCH_2COOH$, $C_2H_5SCH_2CH_2COOH$, $o-C_2H_5SC_6H_4COOH$ with the following metals: Cu, Ni, Pb, Cd, Co, Zn, Mg. The order of stability for the metal derivatives of a given ligand

is the same as that previously established for coordination through oxygen and/or nitrogen. Also five-membered chelate rings are more stable than six-membered chelate rings. For these sulfur containing ligands log k_2 > log k_1 in contrast to the situation usually found for ligands coordinating through oxygen, nitrogen, nitrogen and oxygen, and nitrogen and sulfur. (auth)

4888

North Carolina Univ.
ZIRCONIUM (AND HAFNIUM) TETRACHLORIDE DIETHYL PHTHALATE. R. V. Moore and S. Y. Tyree. [1953] 8p. Contract AT(40-1)-234. (ORO-123)

Zirconium tetrachloride · diethyl phthalate and the corresponding hafnium compound were prepared. Heats of formation of the addition compounds from the metal halide and free ester are reported. The compounds are stable in dry air. They undergo pyrolysis above 150° to give ethyl chloride and metal dichloride−phthalate principally. (auth)

4889

Radiation Lab., Univ. of Calif., Berkeley
CHEMISTRY DIVISION QUARTERLY REPORT [FOR] DECEMBER 1953, JANUARY, FEBRUARY 1954. Apr. 1, 1954. 55p. Contract W-7405-eng-48. (UCRL-2531)

A method is given for the simple measurement of the light transmitted through a suspension of microörganisms. It is shown that with this technique the spectrum of the suspension measured by E_t gives sharp absorption bands with detailed structures. A new technique, which can be completed in 55 min, is proposed for the detection of the position of small quantities of labeled chemical compounds on chromatographic paper. A more extensive instrument has been devised for measuring the metabolic rate of C in rats. A calorimetric device was constructed to determine the irradiation energy delivered by a linear electron accelerator. The fluctuations in the concentrations in metabolic intermediates that result when external conditions are changed are being studied. Mannoheptulose phosphate has been detected in avocado leaves. An extensive investigation of the influence of ecological factors on the biosynthesis of C^{14}-labeled sedoheptulose in Sedum has been made. The effect of controlled variation of incident-light intensity on the culture density and relative chlorophyll content of algae was studied. The hydrolysis of ribulose diphosphate in dilute acid does not appear to be a straightforward hydrolysis to ribulose-5-phosphate as was expected. The enzymatic carboxylation of the diphosphate was also studied. The investigations on the incorporation of adenine into nucleotides, RNA, and DNA in C54 male mice have been continued with special emphasis on the metabolism of adenine-4,6-C^{14} shortly after administration. The metabolism to $C^{14}O_2$ of $NaC_2H_3O_2$-2-C^{14} plus coenzyme A has been measured. Trimethyl-C_1^{14}-3-propanol ammonium chloride and β-carotene-15,15′-C_2^{14} were synthesized. Experiments on the metabolism of fatty acids and the effects of heparin on the metabolism were extended to guinea pigs. The coenzyme A content of normal and pantothenic acid-deficient rats was determined colorimetrically. The K/L capture ratio of Tl^{204} was measured as 3. Preliminary results on small amounts of a $Pu^{238,239,240,242}$ mixture indicate that the yield of a given spallation product at 20 to 50 Mev is dependent not only on the Z^2/A of the parent nucleus, but also on its odd-even characteristics. The lattice constants of potassium thiosemicarbazido dithiocarbonate were determined. Structure and lattice parameters of ThF_4, $InCl_3$, Eu_2O_3, Gd_2O_3, Lu_2O_3, and $AuCl_3$ were measured. Calculations were made of the rotation-vibration interaction in heavy even-even nuclei. A general formula, applicable to odd nuclei as well as even for the matrix elements of the quadrupole interaction in α decay

was derived and some numerical values were tabulated. Numerical integrations of the coupled α-decay equations for Cm^{242} are being carried out. The γ-ray spectra of the 97-min Ba and its 1.6-min Cs daughter, produced by N-ion bombardment of In, have been studied, and a decay scheme was determined. Ion exchange can be used to separate divalent metal ions as Cu, Co, Ni, Ca, Sr, Ba, Hg, Cd, and Zn. Zr and Hf can be separated by solvent extraction with isovaleroyltrifluoroacetone. Work is continuing on the design and construction of mass and β spectrometers. Isotope shifts of Am are tabulated. A decay scheme is proposed for Am^{238}, Np^{240m}, and/or Np^{241}. Experimental results of the fluoride complexing of Sc^{+3} at 15 and 35°C are reported. (For preceding period see UCRL-2455.) (J.S.R.)

4890

THE SYSTEM LITHIUM SULPHATE−AMMONIUM SULPHATE−WATER. A. N. Campbell, W. J. G. McCulloch, and E. M. Kartzmark (Univ. of Manitoba, Winnipeg, Canada). Can. J. Chem. 32, 696-707(1954) July.

The binary eutectics $Li_2SO_4 \cdot H_2O$−ice and $(NH_4)_2SO_4$−ice as well as the ternary eutectics $Li_2SO_4 \cdot H_2O$−$Li_2SO_4 \cdot (NH_4)_2$-SO_4−ice and $(NH_4)_2SO_4$−$Li_2SO_4 \cdot (NH_4)_2SO_4$−ice were determined as to temperature and composition. The complete solubility isotherms at 0.1, 71.8, and 95.2°C. were investigated. The enthalpies of solution of lithium sulphate monohydrate, of ammonium sulphate, and of double salt were determined (in water at room temperature), and from these data, as well as from the solubility isotherms, it has been shown that the temperature of the transition of the double salt, $Li_2SO_4 \cdot (NH_4)_2SO_4$, to its component single salts (in the presence of water) is approached by lowering the temperature, but this transition temperature is still far from reached when the system freezes completely. (auth)

AEROSOLS

4891

California Univ., Berkeley
LIGHT SCATTERING STUDIES IN AEROSOLS WITH A NEW COUNTER-PHOTOMETER. Chester T. O'Konski and George J. Doyle. June 16, 1954. 50p. Contract ONR-222-12, Technical Report 1. (NP-5220)

A versatile light scattering instrument of high sensitivity is described which employs a right-angle collecting system and can be used to determine the distribution of particle sizes in aerosols, by counting and classifying individual particles, and to record the light scattering intensities from aerosols and gases. Procedures have been developed for calibration of the counter with the uniform polyvinyltoluene and polystyrene latex preparations. The degree of monodispersity of a test aerosol produced by spray-drying these preparations was considered in detail. Pulse amplitude distribution measurements were made on 0.33, 0.5, and 1μ diameter particles. The results indicate the scattering signal per particle, in our optical system, is proportional to the square of the diameter. The resolving power of the counter lies within a standard deviation of 8% in particle diameter. Methods were developed to employ gases as standards for particle counting work. It was found that the measured scattering intensities from He, H_2, N_2, CO_2, SO_2, and CH_3Cl increase with the square of the mean molecular polarizabilities, as expected. The limit of sensitivity of the photometer corresponds to 9.0×10^{-11} g/liter of a 0.3μ diameter test aerosol. (auth)

ANALYTICAL PROCEDURES

4892

Johns Hopkins Univ.
THE DETERMINATION OF NITROGEN BY THE DUMAS

METHOD. Alsoph H. Corwin and Ann L. Claggett. Dec. 31, 1952. 23p. Contract Nonr-248(21). (NP-4448; AD-6106)

4893

Wayne Univ.

DETERMINATION OF RADIOACTIVE CESIUM IN FISSION PRODUCTS. Richard B. Hahn and Roy O. Backer. [1954?] 13p. Contract [AT(11-1)-213]. (AECU-2903)

Methods were investigated for the separation and radiometric determination of Cs^{134} in fission products, and data are presented on results following precipitation of Cs with dipicrylamine and with periodic acid, using Cs or K as carrier. (C.H.)

4894

Wayne Univ.

THE DETERMINATION OF RADIOACTIVE ZIRCONIUM IN FISSION PRODUCTS. Richard B. Hahn and Richard F. Skonieczny. [1954?] 20p. Contract [AT(11-1)-213]. (AECU-2908)

Methods were investigated for the separation and radiometric determination of Zr^{95} in fission products, and data are presented on results following precipitation of Zr with mandelic acid, using stable Zr as a carrier. (C.H.)

4895

Wayne Univ.

RADIOCHEMICAL METHODS FOR THE DETERMINATION OF PHOSPHORUS-32. Richard B. Hahn and Robert L. Anderson. [1954?] 12p. Contract [AT(11-1)-213]. (AECU-2910)

Methods were investigated for the separation and radiometric determination of P^{32}, and data are presented on results following precipitation of P with magnesium ammonium phosphate, zirconyl phosphate, ammonium phosphomolybdate, silver phosphate, benzidine phosphate, and bismuth phosphate, using PO_4 ions as carrier. (C.H.)

4896

Pitman-Dunn Labs., Frankford Arsenal

COLORIMETRIC DETERMINATION OF CARBON IN TITANIUM. M. Codell, O. W. Simmons, and G. Norwitz. Mar. 1953. 73p. (MR-546; AD-10634)

The method for C detection in Ti involves: dissolving Ti in an $H_2SO_4-HBF_4$ medium; adding HNO_3 to dissolve the TiC; boiling and filtering the solution; and spectrophotometrically reading the yellow coloration from the nitrated organic complex. The determination was made at 450 mμ, the area of greatest sensitivity. The method is applicable to Ti containing up to 0.7% C. The colorimetric determination of C in Ti was compared to the colorimetric determination of C in steels. Other elements of Ti metal do not interfere. The method was rapid and adaptable to the examination of many samples simultaneously. (ASTIA)

4897

Pitman-Dunn Labs., Frankford Arsenal

COLORIMETRIC DETERMINATION OF TANTALUM IN TITANIUM ALLOYS. G. Norwitz and M. Codell. June 1953. 13p. (MR-552; AD-21273)

A colorimetric procedure is proposed for the determination of Ta in Ta—Ti alloy. The tantalum is separated completely from the titanium by two tannin precipitations with an intervening digestion with tannin. The tannin precipitate is ignited, fused with potassium bisulfate, and the melt taken up with ammonium oxalate solution. Pyrogallol is then added, and the intensity of the yellow color is measured. A study was made of the tantalum pyrogallol color to obtain optimum conditions. Elements that would be found in the usual tantalum—titanium alloys do not interfere with the method. More than 0.0025 g of niobium interferes by causing occlusion of titanium by the tannin precipitate. This causes high results for tantalum, since titanium reacts with pyrogallol to produce a yellow color. The presence of more

than 0.0050 g of tungsten causes high results for tantalum because tungsten is partially precipitated by the tannin and reacts with pyrogallol to produce a yellow color. The proposed method is recommended for tantalum—titanium alloys containing 0.05 to 5 per cent tantalum. (auth)

4898

Pitman-Dunn Labs., Frankford Arsenal

DIRECT COLORIMETRIC DETERMINATION OF SMALL AMOUNTS OF TUNGSTEN IN TITANIUM. G. Norwitz and M. Codell. Oct. 1953. 13p. (MR-569; AD-21195)

A direct colorimetric method is proposed for the determination of small amounts (0.005 to 0.3%) of W in Ti. The sample is dissolved in HCl, and the Ti and W are reduced with metallic Zn. Thiocyanate is added, and the yellow color is read at 410 mμ with a spectrophotometer. The effects of varying the amounts of Ti, thiocyanate, and HCl were studied to determine the best conditions for developing the color. An investigation was made to determine the proper wave length for reading the color, the stability of the color, and effect of interferences. (auth)

4899

Department of Mines and Technical Surveys, Mines Branch (Canada)

THE POLAROGRAPHIC DETERMINATION OF COPPER, NICKEL, AND COBALT. A. Hitchen. May 25, 1954. 10p. (NP-5233; TR-117/54)

A method is described for the simultaneous polarographic determination of copper, nickel, and cobalt in cobalt mineral concentrates and tailings and in uranium-bearing ores, leach solutions, and residues. After solution of the sample the copper, nickel, and cobalt are determined in a pyridine—pyridine hydrochloride supporting electrolyte using gelatin as a maximum suppressor. (auth)

4900

Royal Aircraft Establishment, Farnborough, Hants (England)

THE ABSORPTIOMETRIC DETERMINATION OF MAGNESIUM IN TITANIUM METAL. A. Bacon. Sept. 1953. 25p. (RAE-TN-MET-177; AD-21827)

Mg was separated in alkaline solutions, using H_2O_2 to prevent precipitation of the Ti. MgO was redissolved in a standard acid and determined on a Spekker; Eriochrome Cyanine was used as the color reagent. Calibration and temperature-correction graphs were constructed within 2 days, and the Mg content of a Ti metal sample was determined in 3 hr. The method was good for Mg contents of the order of 0.05% in Ti metal to an accuracy of ±0.003%. The values for Kroll sponge Ti showed that the Mg content is variable, sampling is the major difficulty, and the Mg content after arc melting under argon at a pressure of 15 cm of Hg is negligible. (ASTIA)

4901

STUDY OF THE COLORIMETRIC DETERMINATION OF ALUMINIUM IN STEEL. M. Jean. Anal. Chim. Acta 10, 526-53(1954) June. (In French).

Colorimetric determination of aluminum by means of a new reagent, stilbazo, is studied. The investigation leads to a method for the direct determination of aluminum-steel alloys: nitrided steels, magnetic steels. The aluminum is determined by a technique consisting of electrolysis with mercury cathode, separation of titanium and vanadium, if present, by chloroform extraction of the complexes of these elements with cupferron, and, finally, colorimetric determination. During these experimental investigations, observations have been made concerning the influence of a number of elements on the reaction of aluminum with stilbazo. The reactions of vanadium with various reagents (dicyandiamidine, diantipyrylphenylmethane, α-benzoinoxime) and the silico-vanado-tungstic complex have been studied. (auth)

4902

SPECTROCHEMICAL ANALYSIS OF ALUMINUM ALLOYS USING MOLTEN METAL ELECTRODES. Leo D. Frederickson, Jr. and J. R. Churchill (Aluminum Co. of America, New Kensington, Penna.). Anal. Chem. 26, 795-800(1954) May.

The spectrochemical analysis of metals has heretofore been accompanied by variables associated with the structure of the sample. Differences in grain size, distribution of constituents within and between grains, porosity, microscopic shrinkage cracks, and other effects introduced during solidification, heat treating, and working, produce undesirable variations in spectral excitation characteristics. A new approach to the analysis of aluminum alloys, in which all previous metallurgical history is erased by using a molten electrode for spark excitation is presented. The techniques described should extend the application of spectrochemical analysis to such materials as sheet, tube, extrusions, etc., which are not usually amenable to accurate analysis by existing solid electrode procedures. Precision of analysis is comparable with that obtained when solid electrodes are used. (auth)

4903

QUANTITATIVE ANALYSIS OF NIOBIUM AND TANTALUM IN ORES BY FLUORESCENT X-RAY SPECTROSCOPY. William J. Campbell and Howard F. Carl (Bureau of Mines, College Park, Md.). Anal. Chem. 26, 800-5(1954) May.

The application of fluorescent x-ray spectroscopy to the analysis of niobium and of tantalum in their ores was undertaken to provide a rapid yet accurate method for the determination of both of these elements. Three techniques are described. The first is the determination of the niobium—tantalum ratios in oxides chemically separated from ores. The second method consists of several applications of internal standard techniques, and the third method is essentially an additive technique. The accuracy of the final results of these methods is believed to be superior to existing chemical methods. Between ten and fifty samples per day can be analyzed, depending on the type of material. (auth)

4904

RECRYSTALLIZATION OF BARIUM SULFATE FROM FUSED SALTS. Morris Gallant, George J. Schmitt, and Joseph Steigman (Polytechnic Inst. of Brooklyn, N. Y.). Anal. Chem. 26, 846-9(1954) May.

The usual method for sulfate determination consists of the precipitation of the barium salt. The latter strongly coprecipitates many ions, and most variations of the method rely upon either counterbalancing errors or empirical weight calibrations. This investigation has shown that when appropriate precautions are taken, coprecipitated sodium and chloride ions can be quantitatively removed by one fusion of the original precipitate with alkali chlorides, allowing it to resolidify, leaching with barium chloride solution, washing, filtering, and igniting. The necessary precautions include the purification of the alkali chlorides and barium chloride and the use of an excess of barium chloride in the solution used for washing the recrystallized precipitate. The procedure is shown to be applicable to the determination of sulfate in the presence of a large excess of sodium chloride. On the other hand, nitrate is much more difficult to remove by this procedure. The extremely strong tendency of this ion to form solid solutions in barium sulfate is demonstrated by introducing it into the precipitate from an alkali chloride melt. (auth)

4905

MASS SPECTROMETRIC DETERMINATION OF THORIUM. G. R. Tilton, L. T. Aldrich (Carnegie Institution of Washington, D. C.), and M. G. Inghram (Univ. of Chicago and Argonne National Lab., Chicago, Ill.). Anal. Chem. 26, 894-8(1954) May.

The determination of μg and sub μg quantities of Th by the isotope dilution method using Th^{230}/Th^{232} ratio measurements and a high resolution mass spectrometer is presented. Results showed 41.88 ± 0.60 ppm of Th in a granite composite, from 2170 ± 30 to 5375 ± 75 ppm in zircon, 5375 ± 75 ppm in sphene, and 0.410 ± 0.008 ppm in perthite. A colorimetric monitoring gave results of 2180 ppm in zircon, 5550 ppm in sphene, and 44 ppm in the granite composite. Approximately 3 to 5 days were required for each determination. (J.A.G.)

FLUORINE AND FLUORINE COMPOUNDS

4906

Carbide and Carbon Chemicals Co. (K-25)
THE MOLAR POLARIZATION, DIPOLE MOMENT, AND NON-IDEALITY OF 1,2 DICHLOROTETRAFLUORO-ETHANE. Dale W. Magnuson. July 2, 1954. 8p. Contract W-7405-eng-26. (K-1138)

The molar polarization and nonideality of Freon-114 (1,2 dichlorotetrafluoroethane) were measured from 15 to 132°C. The molar polarization is given by the equation $P_m = 27.446 + 1731.0/T°K$, and the permanent electric dipole moment is 0.53×10^{-18} esu-cm. Over this temperature range, the nonideality of Freon-114 can be represented by $A = 2.667 \times 10^8 \ T^{-4} \ atm^{-1}$. (auth)

4907

Pennsylvania State Univ.
RATE AND EQUILIBRIUM STUDIES. 1. FIRST COMPLEX FORMATION OF THENOYLTRIFLUOROACETONE WITH AQUEOUS METAL IONS. Robert W. Taft, Jr. and Edward H. Cook. June 17, 1954. 30p. Contract AT(30-1)-907. (NYO-6587)

The kinetics of first complex formation of thenoyltrifluoroacetone (TTA) with a series of aqueous metal ions were determined spectrophotometrically. The rate-determining step under the experimental conditions employed with Sc^{III}, Mg^{II}, Zn^{II}, and Cu^{II} is the ionization of the β-diketone. With Be^{II}, Fe^{III}, Al^{III}, and Cr^{III} the rate-determining step involves the metal ion. The kinetics with Fe^{III} are shown by a procedure previously used to be consistent with a rate-determining reaction of the metal ion with the enolate ion of TTA. The enthalpies and entropy of activation have been measured for this reaction. Complete interpretation of the rate data for Al^{III} has not been obtained. Fluoride ion is found to catalyze first complex formation with Al^{III}. Only qualitative information has been obtained with Be^{II} and Cr^{III}. The rate data obtained permit estimates for the rate of reaction of the aquated metal ions with TTA enolate ion. The order of rates neither correlates with charge type nor the availability of stable d orbitals in the metal ions but shows a clear parallel with e^2/r, where r is the radius of the bare ion. First formation constants show the stability of the first complex to depend upon both e^2/r and the availability of stable d orbitals. An explanation of the antiparallelism between rate and equilibrium is offered in terms of the nature of the interactions of water molecules and TTA enolate ion with polyvalent ions. (auth)

4908

FLUORIDE MODEL SYSTEMS. IV. THE SYSTEMS LiF—BeF_2 AND PbF_2—BeF_2. D. M. Roy, R. Roy, and E. F. Osborn (Pennsylvania State Univ., State College). J. Am. Ceram. Soc. 37, 300-5(1954) July. (cf. NSA 7-4351).

Additional information on phase equilibria in the subsolidus region of the system LiF—BeF_2 was obtained, and a study was made of the system PbF_2—BeF_2. In the system LiF—BeF_2 the compound $LiBeF_3$ occurs; it decomposes below the solidus at 300°C to yield Li_2BeF_4 and the quartz form of BeF_2. An additional subsolidus compound having the probable composition $LiBe_2F_5$ forms below 275°C. No evidence was found for the existence of the alleged compound

$Li_3Be_2F_7$. In the system $PbF_2 - BeF_2$ two compounds occur: $3PbF_2 \cdot BeF_2$ and $PbF_2 \cdot BeF_2$; the former melts congruently at $482 \pm 5°C$, and the latter at $585 \pm 5°C$. Extensive solid solution exists between $PbF_2 \cdot BeF_2$ and BeF_2. The cristobalite form of BeF_2 crystallizes from glasses of high BeF_2 content at temperatures of $450°C$ or lower but is converted to the quartz form by heating at higher temperatures or in the presence of liquid. (auth)

4909

GRAVIMETRIC DETERMINATION OF FLUORINE AS LANTHANUM FLUORIDE. Alexander I. Popov and George E. Knudson (State Univ. of Iowa, Iowa City). Anal. Chem. 26, 892-4(1954) May.

The sample was converted to fluosilicic acid by a Willard-Winter distillation (Ind. Eng. Chem., Anal. Ed. 5, 7, (1953)). A known amount of a $La(NO_3)_3$ solution was added to completely precipitate the fluorides, and the excess La was then determined by precipitation with cupferron. The procedure was tested by analysis of samples of pure NaF and CaF_2. The results agreed with the theoretical percentage. The effect of interfering ions, such as chloride and perchlorate ions, and acidity are discussed. The method was also applied to samples of Na monofluorophosphate, and p-fluoroacetanilide, and results are tabulated. (J.A.G.)

4910

DETERMINATION OF FLUORIDE; PROCEDURE BASED UPON DIFFUSION OF HYDROGEN FLUORIDE. Leon Singer and W. D. Armstrong (Univ. of Minnesota, Minneapolis). Anal. Chem. 26, 904-6(1954) May.

A polyethylene apparatus is described and diagramed in which a sample to be analyzed for fluoride is treated with $HClO_2$ and the HF evolved is collected. The HF is then determined either by titration or fluorimetry. Results of application of the method to aqueous solutions of NaF and to ashed bone are shown. In most cases quantities of fluoride of the order of 2 or 3 μg were actually determined. The diffusion blank appeared to be negligible. (J.A.G.)

4911

DETERMINATION OF WATER IN EASILY HYDROLYZED FLUORIDES. Joseph G. Feibig and James C. Warf (Iowa State College, Ames). Anal. Chem. 26, 927-8(1954) May.

A two-section apparatus fabricated from standard Ni pipe is described; the first section holds a 1- to 10-g specimen of fluoride and is regulated to $500°C$, and the second section is for reconversion of HF to water with Na_2CO_3 at $300°C$. The general procedures and precautions of combustion analysis were followed. The water contents of samples of ThF_4 and UF_4 used to test the method were calculated by subtracting the total metal and F percentages from 100. Water contents calculated and found for ThF_4 agreed within a few hundredths of 1%, but the difference for UF_4 was more than 0.5%. When 10-g samples of commercial anhydrous UF_4 and BeF_2 were used satisfactory precision was obtained. (J.A.G.)

LABORATORIES AND EQUIPMENT

4912

Isotopes Div., Advisory Field Service Branch, AEC EQUIPMENT FOR RADIOISOTOPE LABORATORIES. Oscar M. Bizzell. July 1954. 19p. (AECU-2875)

Equipment necessary for a radiochemical laboratory is discussed, and adaptations of simple and inexpensive equipment and apparatus for radioisotope work are suggested. (C.H.)

4913

Knolls Atomic Power Lab.
DECONTAMINATION AND REMODELING OF A HIGH LEVEL CHEMISTRY CELL. B. V. Coplan and D. J. Smith.

May 26, 1954. 19p. Contract W-31-109-Eng-52. (AECU-2902)

A hot cell containing a separations pilot plant, after operating for three years at high activity level, was decontaminated and remodeled. The timing, cost, and manpower requirements for the reconstruction and decontamination are discussed. Decontamination procedures and corresponding radiation reductions are reported, followed by a discussion of the design revisions necessary to reduce future maintenance. (auth)

4914

QUANTITATIVE CATHODE RAY POLAROGRAPHY. K. Cruse and W. Heberle. Z. Elektrochem. 57, 579-90 (1953). 18p. (AEC-tr-1837)

The characteristics of the oscillographic polarogram, whose manufacture is desired for the investigation of reaction kinetics problems, require a special type of apparatus. The structure, function of the structural parts, and possible uses of a cathode-ray polarograph are described, with which quantitative oscillograms were obtained, whereby absorption according to the tripping method (with permanent adjoining oscillating potential) or according to the impulse method (by oscillating potential synchronized with dropping) can be chosen. (auth)

RADIATION CHEMISTRY

4915

INFLUENCE OF DISSOLVED GASES ON HYDROGEN PEROXIDE FORMATION AND BACTERIOPHAGE INACTIVATION BY RADIATION. Michael Ebert and Tikvah Alper (Hammersmith Hospital, London). Nature 173, 987-9(1954) May 22.

The behavior of the free radicals formed during the irradiation of H_2O_2 and the inactivation, during short-time irradiation, of bacteriophage in very dilute suspension were studied. Results of determinations of H_2O_2 in H_2O irradiated in the presence of various dissolved gases showed that at 3 different dose levels the maximum H_2O_2 concentrations obtained with mixtures of H_2 and O_2 were roughly double the concentrations with 100% O_2. Inactivation of bacteriophage experiments revealed that at high dose rates survival curves were of exponential form for both electron and x irradiation. (J.A.G.)

4916

GAMMA-ACTIVATION OF SYNTHESES—POLYMERIZATION OF ETHYLENE. John G. Lewis, Joseph J. Martin, and Leigh C. Anderson (Engineering Research Inst., Univ. of Mich. Ann Arbor). Chem. Eng. Progr. 50, 249-55(1954) May.

Reactions in the polymerization of ethylene gas, both pure and mixed with other compounds, when irradiated with γ radiation from a Co^{60} source are discussed in detail. (C.H.)

RADIATION EFFECTS

4917

New York Univ.
STUDIES OF PHOTOCONDUCTIVITY AS A FUNDAMENTAL PROPERTY OF PHOSPHORESCENT MATERIAL. QUARTERLY PROGRESS REPORT NO. 7 FOR DECEMBER 15, 195[2] TO MARCH 15, 1953. Hartmut Kallmann. July 1953. 50p. Contract DA-36-039-sc-15297. (AD-16777)

Photocurrents in 23 substances were studied by depositing the substances on conductive glass electrodes in powder form and irradiating them with ultraviolet light of about 10 $\mu w/sq$ cm. The currents obtained for the highest potential that could be applied to each sample are listed. Chrysene showed the greatest ultraviolet photoconductivity, and 9,10-dichloro-1,3-dibromoanthracene showed the greatest visible light photoconductivity. Discussions are given pertaining to the sensitivity of interior polarization to low light intensities, substances showing interior polarization,

dark polarization in powder 1508, visible light polarization in quenched 1508 powder, polarization produced by fast electron bombardment, charge distribution in a polarized sample, and the effect of preillumination on ultraviolet polarization. Measurements of the induced light emission and conductivity of RCA no. 2048, a Cu-activated ZnCdS (76% ZnS, 24% CdS) were made. The induced-current and quenching curves are almost identical to those for RCA 2040 which contained no Cd. The polarity effect decreases from a factor of 5 at low voltage to only 2 at high voltage. Three methods for accurately measuring photoconductivity are discussed. (For preceding period see AD-11889.) (auth)

4918

New York Univ.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA. PROGRESS REPORT NO. 3. Hartmut Kallmann. Apr. 1954. 84p. Contract DA-36-039-sc-42626. (NP-5226)

Results are reported from studies of the fluorescence of dilute liquid organic solutions under high energy radiation, and mechanisms of energy transfer are discussed. Investigations of the long time phosphorescent decay of anthracene, durene, stilbene, and naphthalene were continued, and data are summarized. Light emission as a function of time was investigated in various phosphors in the region of 100 μsec to 0.1 sec. The apparatus used in the measurements was modified and excitation instigated by a burst of about 100 electrons made quantitative measurements possible. Studies of light emission as a function of time, shape measurements, variable resistance measurements, and integrated intensity measurements were made on anthracene, diphenyl acetylene, stilbene, naphthalene, cesium bromide(Tl), cesium iodide(Tl), sodium chloride (AgCl 5%), potassium bromide (TlBr 0.5%), calcium tungstate, and zinc sulfide. (For preceding period see NP-4968.) (C.H.)

RARE EARTHS AND RARE-EARTH COMPOUNDS
4919

Radiation Lab., Univ. of Calif., Berkeley
LATTICE PARAMETERS OF SOME RARE EARTH COMPOUNDS AND A SET OF CRYSTAL RADII. D. H. Templeton and Carol H. Dauben. June 1, 1954. 13p. Contract W-7405-eng-48. (UCRL-2606)

Unit cell dimensions are given for the compounds $CeCl_3$, $PrCl_3$, $SmCl_3$, $EuCl_3$, and $GdCl_3$ (hexagonal UCl_3 type), Sm_2O_3, Eu_2O_3, Gd_2O_3, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3, and Lu_2O_3 (cubic Mn_2O_3 type), TbF_4 (monoclinic UF_4 type), and $TbOF$ (rhombohedral $LaOF$ type). A set of empirical crystal radii for the trivalent rare earth ions is proposed. (auth)

4920

CUPFERRON AND NEOCUPFERRON COMPLEXES OF THE RARE EARTH ELEMENTS. Alexander I. Popov and Wesley W. Wendlandt (State Univ. of Iowa, Iowa City). Anal. Chem. 26, 883-6(1954) May.

Cupferron and neocupferron show definite promise as precipitating reagents for the rare earth ions. The exact conditions of precipitation and the properties of the resulting complexes have not been reported in literature. In this work it was found that precipitation seems to be quantitative, but the precipitates are somewhat contaminated by coprecipitation. Ignition of the cupferrates and the neocupferrates to corresponding oxides yields analytical results which compare favorably with the oxalate method. The precipitates are somewhat soluble below pH 2.0 and the optimum pH for precipitation seems to be around 3.5. Conductimetric and h-f titrations indicate formation of an intermediate 1 to 1 complex $MCup^{++}$. (auth)

4921

ACTIVATION ANALYSIS OF SEVERAL RARE EARTH ELEMENTS. A COMPARISON WITH SPECTRO-PHOTOMETRIC PROCEDURES. W. Wayne Meinke and Richard E. Anderson (Univ. of Michigan, Ann Arbor). Anal. Chem. 26, 907-9(1954) May. (cf. NSA 7-4063).

Various rare earths, Sm, Eu, Dy, and Ho, were analyzed by neutron activation and by spectrophotometry for comparative purposes. Results indicated that the latter is best with Sm and Ho but can be supplemented with the activation analysis for Dy and Eu. In an investigation of mixtures of the rare earths, it was found that Eu can be determined in the presence of Sm and Dy in the presence of Ho more readily by activation analysis techniques using appropriate bombardment times than by spectrophotometry. (J.A.G.)

SEPARATION PROCEDURES
4922

Brookhaven National Lab.
TRIOSEPHOSPHATE DEHYDROGENASE FROM PLANT TISSUE. D-GLYCERALDEHYDE-3-PHOSPHATE + PO_4 + TPN(DPH) $\rightleftharpoons$ 1,3-DIPHOSPHOGLYCERIC ACID + TPNH(DPNH). Martin Gibbs. [1953?] 7p. (BNL-1840)

4923

SEPARATION OF HEAVY WATER. [Separation De L'eau Lourde]. M. Romaniw. Translated from Belgium Patent No. 485, 904. Nov. 19, 1948. 3p. (AEC-tr-1792)

The method described for separating heavy water from water widely distributed in nature is based on the difference between the freezing point of heavy water (3.8°C) and the freezing point of light water (0°C). Procedures used in the process are outlined. (C.H.)

4924

PAPER CHROMATOGRAPHY OF METAL 2-THENOYLTRI-FLUOROACETONE CHELATES. Eugene W. Berg and Russell T. McIntyre (Louisiana State Univ., Baton Rouge). Anal. Chem. 26, 813-14(1954) May.

Partition data collected in a solvent extraction study of the metal 2-thenoyltrifluoroacetone chelates suggested that many of the chelates might be separated by a chromatographic technique. Mixtures of the following metal chelates were completely resolved on paper by the proper selection of solvent system and adsorbent impregnated paper: iron(III), cobalt(II), and nickel(II); iron(III), nickel(II), and manganese(II); and copper(II), nickel(II), and manganese(II). A mixed solvent consisting of benzene, methanol, and acetic acid proved most effective for the separations when using plain paper, or paper impregnated with alumina or sodium chloride. (auth)

SYNTHESES
4925

Wayne Univ.
GLYCOLATES AND LACTATES OF ZIRCONIUM AND HAFNIUM. Richard B. Hahn and Richard F. Skonieczny. [1954?] 7p. Contract [AT(11-1)-213]. (AECU-2909)

Methods for the preparation of Zr glycolate, Hf glycolate, Zr lactate, and Hf lactate are described, and the properties of the compounds are discussed. (C.H.)

TRITIUM AND TRITIUM COMPOUNDS
4926

Knolls Atomic Power Lab.
THE ION-PAIR YIELD OF THE TRITIUM-OXYGEN REACTION. L. M. Dorfman and B. A. Hemmer. Apr. 14, 1954. 31p. Contract W-31-109-Eng-52. (KAPL-1111)

The rate of reaction of tritium and oxygen, initiated by the tritium beta radiation, was investigated at 25°C in the absence of mercury vapor by using a sensitive Bourdon gage as the manometer. The rate is not linear with time

but shows a small continual decrease as the reaction proceeds. The initial reaction rate was found to be directly proportional to the tritium pressure and hence proportional to the radiation intensity. It was independent of the oxygen concentration over the range investigated. The reaction rate shows a slight dependence on the isotopic composition of the hydrogen reactant, tending to rise with increase in the mole fraction of protium. The initial reaction rate may be represented by $R_0 = 1.19 \times 10^{-4}\ C_{T_2}\ (1 + 0.3\ m_H)$, where C_{T_2} is the tritium concentration in moles/liter or other absolute concentration units, and m_H is the mole fraction of protium in the hydrogen reactant. On the basis of a requirement of 33 ev per ion pair in the reactant mixture, the initial ion-pair yield for tritium disappearance or water formation is $(M/N)_0 = 3.2_5$ for the reaction of pure tritium with oxygen. Material balance measurements indicate that little or no peroxide appears in the product. (auth)

4927

Institute for Nuclear Studies, Univ. of Chicago
RESEARCH TO ASSAY RAIN AND SURFACE WATER FOR NATURAL TRITIUM CONTENT. FINAL REPORT. W. F. Libby. June 1, 1954. 31p. Contract AF-18-(600)-564. (OSR-TN-54-142)

The measurement of the abundance of tritium in natural waters has been continued during the last eighteen months. The method used consists of the electrolytic concentration of the water samples, the measurement of the deuterium concentration in the final product from which the enrichment factor for any tritium present in the original sample can be calculated, followed by the determination of the tritium content of the concentrate by placing it as gaseous hydrogen in a Geiger counter. (cf. NP-5076.) (auth)

URANIUM AND URANIUM COMPOUNDS

4928

Harvard Univ.
SYNTHESIS OF URANIUM MINERALS. ANNUAL REPORT FOR JULY 1, 1953—JUNE 30, 1954. Clifford Frondel, Richard L. Collette, Virginia Ross, and Eleanor Berman. May 1954. 18p. Contract AT(30-1)-1403. (RME-3101)

WASTE DISPOSAL

4929

DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.
DISPOSAL OF ACTIVE WASTES AT SEA. James E. Evans. Apr. 10, 1952. Decl. Apr. 9, 1954. 14p. Contract AT(07-2)-1. (DP-5)

A possible method for disposal of aged radioactive waste-concentrates 100-ft beneath the ocean floor at depths of 15,000 ft is described. (auth)

ENGINEERING

4930

Polytechnic Inst. of Brooklyn
DEFORMATIONS AND STRESSES IN CIRCULAR CYLINDRICAL SHELLS CAUSED BY PIPE ATTACHEMENT. PART 1. SUMMARY OF THE INVESTIGATION. N. J. Hoff, J. Kempner, S. V. Nardo, and F. V. Pohle. Nov. 1953. 74p. Contract W-31-109-Eng-52, Subcontract K-130 to Knolls Atomic Power Lab. (KAPL-921)

The state of stress and deformation is calculated for a thin-walled circular cylindrical container when a radial load, a circumferential moment, and a longitudinal moment

are transmitted to it through the attachment of a pipe. In a first approximation the load can be distributed along a segment of a generator of a length slightly smaller than the diameter of the pipe. In a first correction to the stress quantities so obtained the pipe can be considered as a rigid body. The solution of the basic problem was obtained by using Donnell's differential equations of the thin-walled circular cylindrical shell. Explicit expressions were derived for all the deflection and stress quantities corresponding to an arbitrary Fourier component of the load function. The correction theory was developed from the differential equations of flat circular plates. The effect upon the stresses and deformations of changes in the physical parameters was explored. The accuracy of the solution was tested by comparing numerical results obtained by it with results calculated from a more complete set of differential equations. In the single case so treated the differences found were well within the requirements of engineering accuracy. Numerical results were also compared with published experimental data, and satisfactory agreement was found. (auth)

4931

Langley Aeronautical Lab., NACA
EXPERIMENTAL STRESS ANALYSIS OF STIFFENED CYLINDERS WITH CUTOUTS. SHEAR LOAD. Floyd R. Schlechte and Richard Rosecrans. Mar. 12, 1954. 87p. (NACA-TN-3192)

A cylindrical semimonocoque shell of circular cross section was mounted as a cantilever and loaded by a direct shear at the tip. The cylinder was tested with no cutout, with a rectangular cutout on the tension side, and with the cutout centered on the neutral axis on one side of the cylinder. The cutout was successively enlarged through six sizes varying from 30 to 130° in circumference and from 1 and 2 bays in length. Strain measurements were made with resistance-type wire strain gages near the cutout on the stringers, the skin, and the rings for each case, and the stresses obtained are presented in tables. (auth)

4932

Petroleum Refining Lab., Penna. State Univ. Coll. of Chemistry and Physics.
FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. QUARTERLY REPORT FOR JANUARY, FEBRUARY, AND MARCH 1954. May 1, 1954. 107p. Contract AF33(038)-18193. (PRL-5.10)

HEAT TRANSFER AND FLUID FLOW

4933

Institute for Fluid Dynamics and Applied Mathematics, Univ. of Md.
ON THE STABILITY OF ISOTROPIC TURBULENCE. Robert Betchov. Sept. 1953. 27p. Contract AF18(600)-86. (AD-18501; BT-15)

4934

Columbia Univ.
ACCELERATION PRESSURE DROPS IN TWO-PHASE FLOW. William Begell and John W. Hoopes, Jr. Apr. 1954. 14p. Contract AT(07-2)-1, Dupont Subcontract AX-294. (CU-18-54-At-dP-Ch.E.)

A procedure for a stepwise trial-and-error method of obtaining pressure drops in a two-phase water—steam system is described using the Martinelli-Nelson equations for stratified flow. The procedure may be applied to the prediction of pressure drops in nuclear reactors with boiling coolant and in steam boilers, evaporators, and condensate return lines. A nomograph for steam qualities up to 25% and over the temperature range 170 to 350°F for rapid evaluation of two-phase acceleration pressure drop and a chart for rapid computation of the Lockhart and Martinelli

empirical parameter X_{tt} are presented. This parameter for two-phase flow equals the square root of the ratio of liquid friction drop to vapor friction drop, assuming each phase flowing alone. The subscript "tt" presumes that both the liquid and the vapor in the flowing two-phase fluid are in turbulent flow. (auth)

4935
Ames Aeronautical Lab., NACA
MEASUREMENT OF HEAT TRANSFER IN THE TURBULENT BOUNDARY LAYER ON A FLAT PLATE IN SUPERSONIC FLOW AND COMPARISON WITH SKIN FRICTION RESULTS. C. C. Pappas. May 6, 1954. 33p. (NACA-TN-3222)

Local heat-transfer rates and average skin-friction coefficients on the surface of a heated flat plate at zero incidence to the air stream at Mach numbers of 1.69 and 2.27 are presented for a Reynolds number range of 10^6 to 10^7. The variation of heat transfer with Mach number was found to be the same as that of directly measured skin friction on unheated bodies. (auth)

4936
Oak Ridge National Lab.
FORCED CONVECTION HEAT TRANSFER BETWEEN PARALLEL PLATES AND IN ANNULI WITH VOLUME HEAT SOURCES WITHIN THE FLUIDS. H. F. Poppendiek and L. D. Palmer. May 21, 1954. 32p. Contract W-7405-eng-26. (ORNL-1701)

A mathematical analysis is presented of forced convection heat transfer between parallel plates which are infinite in extent and ducting fluids containing uniform volume heat sources; also heat is transferred uniformly to or from the fluids through the parallel plates. Dimensionless differences between the plate wall temperature and the mixed-mean fluid temperature are evaluated in terms of several dimensionless moduli. These analyses pertain to the laminar and turbulent flow regimes and liquid metals as well as ordinary fluids. The solutions may also be used to estimate heat transfer in annulus systems whose inner to outer radius ratios do not differ significantly from unity. (Cf. ORNL-1395.) (auth)

4937
THE MOMENTUM AND VORTICITY TRANSFER THEORIES OF TURBULENT HEAT TRANSFER. A. W. Marris (Univ. of British Columbia, Vancouver, Canada). Can. J. Phys. 32, 419-29(1954) June.

The case of heat transfer by a cylindrical turbulent region is examined theoretically from the standpoint of the vorticity transfer analogy. The radial distribution of the eddy diffusivity for vorticity is considered and, on the logarithmic velocity distribution law for fully developed turbulence, this quantity is found to be negative throughout an interval at the outer boundary of the turbulent region. When this region is excluded from the relevant integrals, results are obtained for the Nusselt modulus and radial temperature distribution for the particular case of Prandtl number equal to the ratio of the eddy diffusivities for vorticity and heat, and are compared with the corresponding results on the momentum transfer analogy theory. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

4938
Knolls Atomic Power Lab.
THE DIFFUSION OF HYDROGEN THROUGH MATERIALS OF CONSTRUCTION. P. S. Flint. Dec. 14, 1951. Decl. Feb. 2, 1954. 128p. Contract W-31-109-Eng-52. (KAPL-659)

Results on the investigation of the rate of diffusion of hydrogen through several types of stainless steel and other materials of construction are reported with particular emphasis on Type 347 stainless steel. The use of coatings to reduce the rate is also discussed. Measurements of the diffusion rate were made using an all metal diffuser of new design at temperatures from 100 to 900°C. It was found that the rate of diffusion for Type 347 stainless steel can be represented for the temperature range 200 to 600°C by the equation: $\log S = 2.19 - 3.18 \times 10^3/T$, where S, the diffusion constant, is expressed in cc(STP)/cm²/hr/mm at 760 mm of hydrogen pressure, and T is the absolute temperature. Above 600°C, the rate of diffusion is progressively greater than indicated by the equation (at 800°C the rate is 2.7 times the calculated value). Other stainless steels investigated were Types 304, 410, 420, 316, and 321. In addition, low-carbon steel, aluminum, and Sylvania Alloy #4 were studied. Variations of as much as 50% under identical conditions were observed in the diffusion rate of different specimens of one type of stainless steel. The small variations of composition of the austenitic stainless steels, including the addition of stabilizers, appeared to produce little change in the rate. The effects of various coatings on the rate of diffusion of hydrogen through Type 347 stainless steel are reported. Nitriding the surface of the diffuser was found to have little or no effect on its permeability to hydrogen. A low-contraction chrome plate was found to reduce the rate 40-fold, but the plate cracked off during thermal cycling in hydrogen. A calorized diffuser (Al clad) had a rate 100-fold lower than clean metal. Ceramic coatings, specially synthesized to have coefficients of expansion compatible with that of stainless steel, reduced the rate as much as 200-fold. A spinel coating, produced by treating Type 347 stainless steel with wet hydrogen at temperatures up to 1000°C, also reduced the rate 200-fold below that of clean metal. The results of the rate of hydrogen diffusion due to reaction of stainless steel with atmospheric moisture at elevated temperatures are also given. A review of the theory of diffusion and of the permeabilities of a number of common metals and alloys is included, as is a brief review of the solubility of hydrogen in these metals. (auth)

CERAMICS AND REFRACTORIES
4939
Pennsylvania State Coll. School of Mineral Industries.
REFRACTORY MATERIALS FOR USE IN HIGH TEMPERATURE AREAS OF AIRCRAFT. BI-MONTHLY PROGRESS REPORT. MEMO REPORT NO. 17. W. H. Earhart and N. R. Thielke. Feb. 16, 1953. 38p. Contract AF33(616)-139. (AD-15955)

The method of differential thermal analysis was applied to a study of oxidation of powdered carbides and metals. Exothermic heat effects of variable magnitude were noted in all cases. Several indices of stability, which were computed, demonstrated generally that TiC, among others, is relatively easily oxidized, whereas Cr and Si carbides are much more resistant in this respect. Similarly, Cr and Si are more stable than Mo or Ni. The relationship between oxidation resistance of sintered compacts and differential thermal analysis of powders was investigated by studying selected commercial cermet compositions. The data were insufficient to establish the correlation between weight-gain measurements and heat effect observed by differential thermal analysis procedures. (auth)

4940
Armour Research Foundation
RESEARCH ON APPLICATION OF FUNDAMENTAL CONCEPTS OF BONDING METALS AND CERAMICS. QUARTERLY PROGRESS REPORT NO. 5 FOR THE PERIOD APRIL 21, 1953 TO JULY 20, 1953. H. N. Barr, H. H. Rice,

and J. A. Stavrolakis. 27p. Contract AF 33(616)-97. (AD-17501)

Preliminary tests covering the synthesis of silicon boride and trials for impregnation and coating of silicon boride with silicon are reviewed. Experiments in which silicon boride-silicon bodies were cold pressed and sintered at 1400°C have not been productive of dense bodies as yet. Mixtures of silicon and boron with and without additions of iron, nickel and cobalt yielded dense hot-pressed bodies with good oxidation resistance. Preliminary results indicate that a body of 70.6% silicon and 29.4% boron, hot pressed at 1500°C, has a density of approximately 2.4, transverse strength of 40,900 psi and good oxidation resistance. The microstructure of the hot-pressed silicon-boron bodies is discussed. Fabrication of manganese boride-silicon bodies has been unsuccessful because undetectable leaks in the gas purification train allowed oxide impurity in the metallic powders. Difficulties were also encountered when hot-pressed bodies adhered to the die punches, causing the specimens to crack when they were removed from the punches. (auth)

4941

Research Foundation, Ohio State Univ.
STUDY OF THE MICROSTRUCTURE OF CERMETS. BIMONTHLY REPORT NO. 16. Herbert W. Newkirk, Thomas S. Shevlin, and Charles A. Hauck. Nov. 1, 1953. 12p. Contract AF-33-(038)-16911. (AD-22891)

Further work on high-temperature x-ray-diffraction studies is described. Control of line voltage is now giving good patterns including the back-reflection region which previously gave trouble. Overhaul of the vacuum quench furnace is discussed as well as the current use of this furnace for heat treating specimens of K 151 A and K 152 B. A program has been worked out for a study of the development of alloys suitable for the metal binder phase in TiC-base cermets which will at the same time have coefficients of expansion matching as nearly as possible the coefficient of expansion of TiC. The advantages accruing from such an expansion and contraction match are discussed, and the preliminary experiments to date are described. Curves are included showing the wide gap between the expansion curves for Ni and for titanium carbide. Also shown are the expansion curves for the commercial alloys Fernico and Fernichrome which were produced in rod form suitable for the determination of the coefficient of expansion. (auth)

4942

Radiation Lab., Univ. of Calif., Berkeley
REACTIONS OF THE REFRACTORY SILICIDES WITH CARBON AND WITH NITROGEN. Leo Brewer and Oscar Krikorian. Apr. 29, 1954. 60p. Contract W-7405-eng-48b. (UCRL-2544)

The silicides of Ti, Zr, Ce, and Nb were investigated to determine the phases present at temperatures around 2000°K. The reactions of silicides of Ti, Zr, Ce, Nb, Ta, Mo, and W with carbon were studied at these temperatures. A limited amount of work was done on the reactions of some of the silicides with nitrogen. The data have been used to establish ternary phase diagrams for the systems and to obtain upper and lower limits for the heats of formation of the silicides. (auth)

4943

RESISTANCE OF REFRACTORIES TO MOLTEN LEAD-BISMUTH ALLOY. James J. Gangler. (Lewis Flight Propulsion Lab., Cleveland, Ohio). J. Am. Ceram. Soc. 37, 312-16(1954) July.

In conjunction with studies of the suitability of liquid metals for high-temperature heat-transfer systems, an investigation was made to determine the resistance of forty materials—eighteen ceramics and cermets, thirteen refractory metals, and nine high-temperature alloys—to attack by Pb-Bi eutectic alloy (44.5% Pb and 55.5% Bi) in a dynamic system at temperatures of 1500 or 2000°F. The experimental apparatus and procedure are described. With the exception of ZrC all the ceramics and cermets were resistant to attack by molten Pb-Bi eutectic at 2000°F. Of the thirteen refractory metals only arc-cast molybdenum exhibited resistance to Pb-Bi at 2000°F. All nine of the high-temperature alloys had poor resistance at 1500°F. (auth)

CORROSION

4944

Climax Molybdenum Co. of Mich.
OXIDATION-RESISTANT COATINGS FOR MOLYBDENUM. QUARTERLY PROGRESS REPORT NO. 3 FOR THE PERIOD APRIL 2, 1953—JULY 1, 1953. J. R. Blanchard. 11p. Contract AF 33(038)-16197. (AD-15186)

Nine different single-layer coatings protected molybdenum from oxidation at 1800°F for at least 500 hours. The most consistent results were obtained with coatings containing aluminum and the following alloys: Ni-Si, Cr-Si, and Fe-Cr-Si. Two single-layer coatings protected molybdenum from oxidation in air at 1800°F for approximately 100 hours, during which exposure the coated specimens were stressed sufficiently to produce elongations of approximately 5% in the gage sections. The coatings were Colmonoy No. 5 and Colmonoy No. 6. (For preceding period see AD-15190.) (auth)

4945

Climax Molybdenum Co. of Mich.
OXIDATION-RESISTANT COATINGS FOR MOLYBDENUM. QUARTERLY PROGRESS REPORT NO. 2 FOR THE PERIOD JANUARY 2, 1953—APRIL 1, 1953. J. R. Blanchard. 9p. Contract AF 33(038)-16197. (AD-15190)

Two single-layer sprayed coatings protected molybdenum from oxidation at 1700°F for at least 500 hours. One two-layer sprayed coating protected molybdenum from oxidation at 1800°F for at least 500 hours. One three-layer sprayed coating and one single-layer sprayed coating protected molybdenum exposed to air at 1800°F for approximately 100 hours, during which exposure the coated specimens were stressed sufficiently to cause elongations of over 2% in the gage sections. (auth)

4946

Research Foundation, Ohio State Univ.
PROTECTION OF MOLYBDENUM AGAINST CORROSION AT HIGH TEMPERATURES. STATUS REPORT NO. 7 FOR THE PERIOD APRIL 16, TO JULY 15, 1953. J. W. Spretnak and Rudolph Speiser. Aug. 1, 1953. 13p. Contract N6onr-2258. (AD-16874)

4947

Stanford Univ. School of Mineral Sciences
INVESTIGATION OF MATERIALS FOR USE IN A HEAT TRANSFER SYSTEM CONTAINING LIQUID LEAD OR BISMUTH. FINAL REPORT. O. Cutler Shepard, James R. Morgan, and Ralph Parkman. June 30, 1954. 31p. Contract AT(11-1)-190, Report No. 16. (AECU-2915)

Data are reported from studies of the dissolving of Fe and Cr from various steels immersed in liquid Pb. (For preceding period see AECU-2794.) (C.H.)

GEOLOGY AND MINERALOGY

4948

Pennsylvania State Univ. Coll. of Mineral Industries
MINERALOGY OF URANIUM-BEARING DEPOSITS IN THE BOULDER BATHOLITH, MONTANA. ANNUAL REPORT [FOR] APRIL 1, 1953 TO MARCH 31, 1954. H. D. Wright, B. H. Bieler, W. P. Shulhof, and D. O. Emerson. Apr. 1,

1954. 78p. Contract AT(30-1)-1390. (RME-3095)

Field work in the Boulder batholith, Montana included mapping of wall rock alteration in the W. Wilson mine, mapping and sampling of the "siliceous reef" veins, chalcedony varieties, and radioactivity in the W. Wilson, G. Washington, and Free Enterprise mines, sampling of secondary uranium minerals in the W. Wilson mine for a distribution study, and mapping and sampling of veins and altered rock in a uranium-bearing "base metal" deposit, the Lone Eagle mine. Rock alteration in the W. Wilson deposit was mapped in zones on the basis of biotite stability, silicification, and primary texture destruction. Textural studies of thin sections correlated with observations of the corresponding remnant chips under the binocular microscope has indicated the following general order of deposition of chalcedony color varieties in the siliceous reef deposits: tan, gray, dark gray and black, followed by an orange to tan opal which is probably secondary. Autoradiographs have shown that the most recent of the several varieties of vein chalcedony is usually the most radioactive; this material is generally found in veinlets and in the cementing material enclosing breccia fragments. Alteration mineralogy in the Lone Eagle deposit is similar to the W. Wilson pattern but exposures were inadequate for complete study. The vein mineralogy is similar in kind, although the ore minerals are more abundant in the Lone Eagle. The general paragenetic sequence is microcrystalline quartz, well formed pyrite, sphalerite with chalcopyrite, galena, and fine pyrite, pitchblende and cryptocrystalline chalcedony, sphalerite and galena with cryptocrystalline chalcedony, and argentite. Field study has indicated a zoning of secondary uranium minerals outward from primary ore shoots in the W. Wilson deposit with gummite, uranophane, beta-uranophane, meta-autunite, and torbernite occurring at successively greater distances from the vein. Field observations suggest that the near-surface reworking process has resulted in depletion rather than enrichment of the ore. (For preceding period see RME-3041.) (auth)

METALS AND METALLURGY

4949

Metallurgical Labs., Dow Chemical Co.
THIRD QUARTERLY REPORT [FOR] OCTOBER 15, 1951 TO JANUARY 15, 1952. PART 1. DEVELOPMENT OF HIGH STRENGTH SHEET FROM POWDER FABRICATED Mg ALLOYS CONTAINING Zn, Zr, AND Al. REPORT NO. 15501. 52p. Contract W33-038-ac-19884(19479), Suppl. Agreement No. 5. (AD-11553)

The successful shell molding of Mg alloy castings was achieved by treating the mold with washes, flushes, and sand-resin mix additions to prevent O, moisture, and silica sand from reacting with the molten alloy. The tests were made on a 1/9/2-ratio Mg-Al-Zn alloy. The most satisfactory mold washes were H_3BO_3 and Dow no. 108 Agent (essentially S and H_3BO_3); the best addition agent was NH_4BF_4. Furfural-phenolformaldehyde and urea-phenol formaldehyde gave the best breakdown properties as core mixes. The shell-cast alloy showed tensile and metallographic properties equivalent to those of metals cast in green sand on permanent molds. (auth)

4950

Metallurgical Labs., Dow Chemical Co.
LARGE SCALE EXTRUSION OF ZK60A ALLOY POWDER. [REPORT NO. 15635]. Feb. 22, 1952. 39p. Contract W33-038-ac-19884(19479), Suppl. Agreement No. 5. (AD-11554)

4951

Massachusetts Inst. of Tech.
SUBGRAIN FORMATION IN HIGH-PURITY ALUMINUM DURING CREEP AT HIGH TEMPERATURES. Andre M.

Gervais, John T. Norton, and Nicholas J. Grant. [1953] 36p. Contract AF-33-(038)-23281. (AD-11805)

A theory of subgrain formation was proposed, based on an investigation of the creep deformation of coarse-grained, high-purity Al at temperatures approaching the melting point. The development of an experimental technique is reported for creep testing and electrolytically etching coarse-grained specimens. Observations were made of kink-band formation and of general substructures. Subgrain boundaries were formed by 2 different processes: kinking, which formed sharp boundaries from the beginning of the deformation process; and polygonization of the smoothly bent regions within the zones formed by prior kinking. As evidence that polygonization was the main factor in subgrain formation, the subgrain size was determined to be a function of the extent of bending and of temperature. Subgrains formed as a consequence of deformation and were not the main cause of deformation. The boundaries formed by polygonization were not parallel to each other because the amount and axes of bending varied due to the extensive inhomogeneity of deformation in creep testing. (ASTIA)

4952

New York Univ. Coll. of Engineering
TITANIUM-ALUMINUM-CHROMIUM ALLOYS. BI-MONTHLY REPORT NO. 2 [FOR] DECEMBER 1, 1952 TO JANUARY 31, 1953. P. Herasymenko and H. Margolin. 27p. Contract NOa(s) 53-018-C. (AD-11887)

Tensile properties and microstructures of Ti-3% Al-5% Cr alloy bars were determined after treatment at 1000°C for 30 min, isothermal transformation at 730°C for 2 hr, and H_2O quenching. Low ductility resulted, probably from O and N contamination. H_2O quenching of fully martensitic structures and subsequent reheating in the $\alpha + \beta$ field gave a good combination of strength and elongation and appeared a practicable method of obtaining isotropy and satisfactory ductility when the material thickness is below 0.5 in. Solution-treated bars quenched at 225°C and immediately reheated to 500 and 650°C were hard and brittle; although reheating in the $\alpha + \beta$ region restored ductility, α particles tended to form at β grain boundaries with a lowering of elongation. Martensite transformation in $\frac{5}{8}$-in. bars of the same heat was studied in specimens transformed at temperatures below 550°C. The β phase appeared to be stabilized at the center of bars quenched from 1000°C in Pb baths at about 350°C; acicular structures formed only on subsequent cooling to room temperature. Immediate reheating from 350 to 500°C yielded a uniformly transformed structure in the whole cross section of the bars. The Vickers hardness was measured for Ti-Al alloys containing 0.3 and 0.7% N and for Ti-Al alloys with 0.7% C in the as-cast condition; the Al content ranged from 5 to 20% Al. The hardening effect of N was not additive to that of Al. The hardness of Ti-Al-N alloys decreased with increasing Al content at a constant N content and reached the same level as in the binary Ti-Al system at 20% Al. (For preceding period see AD-10279.) (ASTIA)

4953

Rem-Cru Titanium, Inc.
THE DEVELOPMENT OF STRONG, TOUGH TITANIUM ALLOYS FOR ORDNANCE USE. FINAL TECHNICAL REPORT. [nd] 70p. Contract DA 19-059-ORD-123. (AD-16263)

4954

Allegheny Ludlum Steel Corp.
RESEARCH AND DEVELOPMENT OF TITANIUM ALLOYS. INTERIM TECHNICAL REPORT NO. 8 [FOR] MARCH 1, 1952—MAY 31, 1952. W. J. Gleason and T. K. Redden. 46p. Contract DA-30-115-ORD-7. (AD-16583)

4955

Smith, A. O., Corp.
TITANIUM FLASH WELD RESEARCH PROJECT. SUM-
MARY REPORT NO. 3. J. J. Duero. May 1, 1953. 19p.
Contract [AF33(038)-20582]. (AD-18856; AD-200)

Attempts were made to evaluate the effect of grain size
in the weld zone on physical properties, to verify previous
conclusions based on furnace anneal heat treatments, and
to evaluate the effect of these heat treatments as compared
to as-welded conditions. The tensile data were insufficient
to permit conclusions as to the effect of upset pressure
on weld quality and ductility. Comparison of ductility results
between as-welded and annealed welds showed definite
advantage gained through annealing. (auth)

4956

Metallurgical Labs., Dow Chemical Co.
A STUDY OF THE HARDENING MECHANISM IN Mg—Li
BASE ALLOYS. [QUARTERLY PROGRESS REPORT NO.
3]. Report No. 15763. July 31, 1953. 9p. Contract
NOas-52-018-c. (AD-19111)

4957

Massachusetts Inst. of Tech.
AN INVESTIGATION OF THE SYSTEMS FORMED BY CHRO-
MIUM, MOLYBDENUM AND NICKEL. David S. Bloom and
Nicholas J. Grant. [1953]. 32p. Contract [NOa(s) 8784].
(AD-19955)

An investigation of the Mo—Ni system resulted in some
changes in the phase diagram in the regions of the eutectic
and peritectic reactions. Interesting phenomena concerning
the intermediate structure associated with the eutectoid
reaction were revealed by the investigation of the Cr—Ni
system. The retained high-temperature phase could be
decomposed by annealing or cold working near room tempera-
ture. The Cr—Mo system as presently accepted was consider-
ed incorrect. Suggestions were made for possible changes of
the diagram. The 1250°C section of the Cr—Mo—Ni system
was developed which shows the shape of the σ phase field at
this temperature. The existence of another ternary compound
called the P phase was corroborated. The liquidus surface
of the ternary was outlined, and a possible system of in-
variant planes for the ternary system Cr—Mo—Ni was sug-
gested. (auth)

4958

Massachusetts Inst. of Tech.
CHROMIUM BASE ALLOYS. PROGRESS REPORT NO. 17.
Albert G. Bucklin, Ahmed el Bindari, Charles Stein, and
Nicholas J. Grant. 1953. 25p. Contract Noas-53-585-c.
(AD-20073)

Progress is reported in investigations of the Cr-rich
portion of the Cr—Ni binary phase diagram, phase studies
on Ni—Cr—Mo ternary alloys, methods of evaluating the
properties of Cr alloys, and the nature of the sigma phase in
Ni—V alloys. (C.H.)

4959

Battelle Memorial Inst.
EQUIPMENT FOR METALLOGRAPHIC STUDIES AT
ELEVATED TEMPERATURES. H. A. Saller, R. F.
Dickerson, and R. J. Carlson. Mar. 2, 1954. Decl. June
25, 1954. 15p. Contract W-7405-eng-92. (BMI-X-114)

A microscope hot stage was constructed which makes
possible the observation of structural changes in a metal at
temperatures up to 1800°F. The principal parts of the
equipment are a vacuum furnace, an optical group, a cold
trap, and a vacuum-pumping group. The structures of
uranium, zirconium, and SAE 1008 steel at elevated tem-
peratures were photographed to illustrate the quality of work
that can be accomplished with the equipment. (auth)

4960

Brookhaven National Lab.
DIFFRACTION STUDIES OF POSSIBLE ORDERING IN α-
BRASS. David T. Keating. [1954]. 9p. (BNL-1848)

4961

North American Aviation, Inc.
ELIMINATION OF BRITTLENESS IN TITANIUM ALLOYS.
Charles W. Handova and Herman C. Ihsen. Jan. 6, 1953.
19p. (NAA-AL-1608; AD-8262)

Minute surface cracks were found to be the cause of the
ultimate failure of Ti and Ti alloys during forming processes.
These cracks were attributed to the low ductility of a thin
surface layer of metal which had absorbed atmospheric N or
O during high-temperature processing and rolling. Removal
of the layer by pickling or etching with a solution containing
about 5 of 50% HF and 15 of 70% HNO_3, by volume, or by
wet grinding resulted in increased ductility in bend tests.
(auth)

4962

Lewis Flight Propulsion Lab., NACA
EVALUATION OF ALLOYS FOR VACUUM BRAZING OF
SINTERED WROUGHT MOLYBDENUM FOR ELEVATED-
TEMPERATURE APPLICATIONS. Kenneth C. Dike. Mar.
16, 1954. 14p. (NACA-TN-3148)

The brazing characteristics of 28 alloys, with liquidus
temperatures in the range 2000 to 2500°F, were established
in vacuum. The tensile strength of butt-brazed molybdenum
joints of 10 of the alloys ranged from 21,000 to 49,000
pounds per square inch at room temperature and 0 to 18,900
pounds per square inch at 1800°F. The three alloys having
1800°F bonding strengths greater than 17,000 pounds per
square inch were heated in vacuum for 24 hours at 1800°F
to determine the effect on tensile strength. This treatment
lowered the strength of one considerably but did not seem
to affect the 84 percent nickel—16 percent titanium and 52
percent niobium—48 percent nickel alloy bonds. Therefore,
these two alloys may be potentially useful for brazing
molybdenum. (auth)

4963

Langley Aeronautical Lab., NACA
TIME-TEMPERATURE PARAMETERS AND AN APPLICA-
TION TO RUPTURE AND CREEP OF ALUMINUM ALLOYS.
George J. Heimerl. Apr. 8, 1954. 36p. (NACA-TN-3195)

The application of time-temperature parameters to stress-
strain, rupture, and creep data for metals and alloys is re-
viewed. Some comparisons are made of theoretical and
experimental parameters. A parameter based upon rate-
process theory was successfully applied to rupture and
creep data for aluminum and various aluminum alloys. The
value of the constant in the parameter, which provided the
best correlation of the data, was determined for each materi-
al and application. Master curves of stress against the pa-
rameter which summarize extensive data on the aluminum
alloys are presented for rupture, minimum creep rate, and
time to 1 or 2% strain. Predictions of long-time life from
short-time data are shown to be possible. (auth)

4964

Langley Aeronautical Lab., NACA
AN INVESTIGATION OF THE CREEP LIFETIME OF 75S-T6
ALUMINUM-ALLOY COLUMNS. Eldon E. Mathauser and
William A. Brooks, Jr. Apr. 22, 1954. 28p. (NACA-TN-
3204)

The results of short-time elevated-temperature creep
tests of 75S-T6 aluminum alloy columns are presented and
examined with the objective of obtaining procedures for
predicting column lifetime. Semiempirical lifetime curves
are obtained with the aid of a previously published column
creep theory, and are used for deriving column curves. A
study is made of the effects of variations of stress and out-

of-straightness on column lifetime. Small variations in out-of-straightness have been found to be of little practical significance; whereas, small stress variations change the column lifetime considerably. Plots that do not explicitly include out-of-straightness are presented and may be satisfactory for predicting column lifetime for design purposes. (auth)

4965

Naval Ordnance Test Station, Inyokern
HIGH-HEATING-RATE STRENGTH OF THREE HEAT-RESISTANT METALS. B. A. Miller, J. M. Winward, and W. K. Smith. Mar. 16, 1953. 20p. (NAVORD-2017; AD-10850)

Type 303 stainless steel in the annealed and in the cold-worked condition, Hastelloy C in the solution-annealed and in the precipitation-hardened condition, and wrought, sintered, pure molybdenum were tested by the high-heating-rate method. This method was developed earlier at the Naval Ordnance Test Station to determine the strength of metals when subjected to constant load and heated at rates comparable to those encountered in rockets. The high-heating-rate strength of molybdenum above 1600°F greatly exceeded that of the other metals tested. Next in order of decreasing strength were Hastelloy C, cold-worked Type 303 stainless steel, and annealed Type 303 stainless steel. Hastelloy C in the precipitation-hardened condition was stronger than in the solution-annealed condition only up to about 1750°F under high-heating-rate conditions. (auth)

4966

National Bureau of Standards
EFFECTS OF CERAMIC COATINGS ON THE CREEP RATE OF METALLIC SINGLE CRYSTAL AND POLYCRYSTAL-LINE SPECIMENS. PROGRESS REPORT NO. 5 [FOR] JUNE 15, 1953 TO SEPTEMBER 15, 1953. Sept. 28, 1953. 10p. Contract AF33 (616)-52-19. (NBS-2815; AD-19894)

4967

Westinghouse Research Labs.
NICROBRAZING TUBES TO A PLATE. G. Comenetz, J. W. Salatka, and J. L. McShane. Jan. 22, 1953. 34p. (NP-5227; R-94476-1-C)

The end of a stainless steel tube which passes through a hole in a stainless steel plate is brazed to the plate with Nicrobraz alloy. Heat for the brazing is applied via the tube bore by radiation from a tungsten filament which forms part of a portable hydrogen-filled brazing lamp. Few if any seals leak. (auth)

4968

General Electric Research Lab.
DEVELOPMENT OF ZIRCONIUM-BASE ALLOYS. NINE-TEENTH QUARTERLY REPORT. (PROGRESS REPORT NO. 20). J. H. Keeler. July 5, 1954. 11p. Contract W-31-109-Eng-52. (SO-2515; RL-1124)

Tensile tests were conducted on zirconium ternary alloys in air at room temperature and in vacuo at 500°C. Tabulated data are presented. The alloys Zr + 3 Al + 5 Mo, Zr + 5 Al + 1 Mo, and Zr + 3 Al + 5 Ta (atomic per cent) had yield strengths greater than 50,000 psi at 500°C. The compound Zr_3Al was found to be ordered face-centered-cubic, of the Cu_3Au type, with an $a_0 = 4.372 \pm 0.003$ A. A summary of the recently completed occasional report, "Preferred Orientations in Beta-Annealed Zirconium," is given. (For preceding period see SO-2514.) (auth)

4969

Minnesota Univ.
DAMPING, ELASTICITY, AND FATIGUE PROPERTIES OF UNNOTCHED AND NOTCHED N-155 AT ROOM AND ELEVATED TEMPERATURES. L. J. Demer and B. J. Lazan. Feb. 1953. 75p. Contract AF 33(038)-18903. (WADC-TR-53-70; AD-13052)

Data are presented on the damping, elasticity, and fatigue properties of N-155 under rotating bending stress. Un-notched and notched specimens at room temperature, 1350, and 1500°F are included in this study. Properties at the three temperatures are compared on two bases, equal stress and equal stress ratio. The change in vertical deflection and run-out for notched specimens are associated with the first evidence of the formation of a fatigue crack. Curves for these first-evidence-of-crack points plotted against stress are compared with the usual S-N fracture diagrams. Effective stress concentration factors are determined from both the fracture and first-evidence-of-crack data, and the latter values are found to be nearly independent of the number of fatigue cycles. Data are presented for both unnotched and notched specimens on the dynamic proportional limit and its relationship to the fatigue strength. Equations are developed for interpreting rotating cantilever beam data so that the effective length of specimen fillets, specific damping energy, and dynamic modulus of elasticity may be calculated. (auth)

4970

Case Inst. of Tech.
THE EMBRITTLEMENT OF ALLOY STEEL AT HIGH STRENGTH LEVELS. L. J. Klingler, W. J. Barnett, R. P. Frohmberg, and A. R. Troiano. July 1953. 84p. Contract AF-33-038-22371. (WADC-TR-53-205; AD-22974)

The embrittlement phenomenon which may occur on tempering quenched steels to high-strength levels is a precipitation or aging phenomenon. The tempering characteristics of the steel play a major role in the development of embrittlement. A structure composed of 100% bainite (low-temperature bainite) is not subject to the same embrittling reaction. Such bainitic structures displayed properties equal or superior to those of tempered martensite at all strength levels. Mixed structures exhibited lower properties. A definite correlation is shown between the time-temperature relations for the embrittlement of tempered martensite and the nature and sequence of the carbides resulting from the tempering process. The embrittlement is associated with the initial formation of platelet cementite. It is proposed that the embrittlement arises from localized precipitation of cementite in the prior austenite grain boundaries which precedes the general precipitation. The localized over aging would then produce a thin ferrite network which embrittles the steel. Three approaches to the problem of minimizing, avoiding, or eliminating embrittlement in steels at high strength levels are: the development of special analyses with retarded martensite tempering characteristics; the development of faster tempering steels so that over aging will occur; and the development of steels in which high-strength bainite can be produced. (auth)

4971

Bureau of Mines. Eastern Experimental Station
ELECTRODEPOSITION OF TITANIUM AND ZIRCONIUM. Robert M. Creamer, David H. Chambers, and Charles E. White. Dec. 1953. 27p. Contract AF 33(038)50-1085. (WADC-TR-53-317; AD-25501)

Aqueous, nonaqueous, and fused electrolytes were investigated in an attempt to electrodeposit titanium and zirconium. Aqueous and nonaqueous electrolytes were found capable only of coplating small percentages of titanium along with another more easily plated metal such as tin, cadmium, or zinc. Fused alkali borate baths were found to give nonadherent, spotty cathode deposits of a titanium boride. Fused halide electrolytes gave powdered metal deposits, and a potassium chloride—lithium chloride-titanium (III) chloride electrolyte gave weighable plates on iron, nickel, and copper cathodes. Notes on some of the chemical aspects of the investigation are included. (auth)

4972

American Brake Shoe Co.
MARTENSITIC HIGH CHROMIUM HEAT RESISTANT STEELS.
FINAL TECHNICAL REPORT. (INCLUDING DATA OB-
TAINED IN THE PERIOD FEBRUARY—AUGUST 1953).
John A. Fellows. Aug. 24, 1953. 20p. Contract DA-30-
069-ORD-237. (WAL-316/45-27; AD-20536)

The addition of 0.0125% Ti to a 24% Cr-base alloy con-
taining 0.35% C, essentially 0% N, and 0.05% Mo resulted in
almost complete lack of ductility. Brittleness was caused
by a continuous carbide network at the grain boundaries.
Further attempts to develop a hard, ductile, tough, high-Cr,
cast alloy from Cr levels about 21% were not recommended.
The use of forged structures was considered promising for
a more favorable combination of hardness and ductility.
(auth)

4973

Rem-Cru Titanium, Inc.
THE DEVELOPMENT OF STRONG, TOUGH TITANIUM
ALLOYS FOR ORDNANCE USE. FINAL TECHNICAL RE-
PORT. [nd]. 77p. Contract DA-19-059-ORD-1007. (WAL-
401/163-14)

A study was made of the effects of common contaminates,
C, Fe, and N, on the strength and toughness of Al—Sn—Ti
and Mn—Ti alloys. (J.E.D.)

4974

Welding Lab., Foster Wheeler Corp.
WELDING PROCEDURE DEVELOPMENT FOR TUBE TO
TUBE SHEET JOINTS IN HEAT EXCHANGERS. (JOB L-
7818-19-A). H. H. Hoffman and Norman Block. Feb. 15,
1954. 136p. (WLR-42.02)

An investigation of procedures for welding type 347 tube
into type 304 tube plates in heat exchangers and thermal
shock tests on heat exchangers are reported. Results in-
dicated that the 3 major problems requiring solution were
elimination of major microscopic defects such as groove
porosity, adjustments of metallurgical conditions to eliminate
cracking, and design of a joint providing control of tube
dilution and ease of manual operation and maximum acces-
sibility. Rolling the tubes into tube sheets, particularly
when employing a water lubricant and performed before
welding, was found responsible for porosity. Close control
of rolling was instituted to alleviate the problem. The
adjustment of weld compositions to provide partially austen-
itic deposits proved successful in solving metallurgical dif-
ficulties. Welds containing 10 to 14% free delta ferrite were
found to be crack resistant under the imposed conditions.
Since bare wire of this composition was unavailable, the
shielded metal arc process, in which the flux coating allowed
adjustment of the chemical composition of the deposit, was
employed. Problems related to electrode usability were
resolved by incorporation of a h-f arc stabilizer and special
control procedures. Excessive tube dilution which often
resulted in crack-sensitive areas at the weld root was
minimized by a combination of joint design and the insertion
of Cu plugs to equalize relative tube and tube plate mass.
(J.A.G.)

4975

[Welding Lab.], Foster Wheeler Corp.
ADDENDA [TO] WELDING PROCEDURE DEVELOPMENT
FOR TUBE TO TUBE SHEET JOINTS IN HEAT EXCHANG-
ERS. (JOB L-7818-19-A). Norman Block. [1954]. 16p.
(WLR-42.04)

Tube sheet deflection and buckling tests during welding
of 347 stainless steel tube to tube sheet joints in Mark II
heat exchangers are reported. Almost negligible tube sheet
deflection was found. In the latter test, initial displacement
of the free tube plate resulted in elastic deflection of the
tube between all supports. However, permanent tube buckling

did not become evident until the tube displacement reached
0.169 in. (J.A.G.)

4976

Metallurgical Labs., Sylvania Electric Products, Inc.
PLASTIC FLOW AND RECRYSTALLIZATION OF TITANIUM.
QUARTERLY PROGRESS REPORT 1 [FOR] MARCH 15,
1953 TO MAY 20, 1953. L. L. Seigle, F. D. Rosi, F. C.
Perkins, L. Sama, and A. J. Opinsky. Aug. 1953. 42p.
Contract AF33(616)442. (YE-53-508; AD-18506)

Slip and twinning planes were determined in deformed
coarse crystals of sponge and iodide titanium at −196 and
500°C. Deformation by slip occurred solely on prismatic
planes of the type $\{10\bar{1}0\}$ at − 196°C and twinning predomi-
nantly on $\{11\bar{2}4\}$. Twinning accounted for a greater propor-
tion of the deformation at −196°C than at room temperature.
Extensive slip at 500°C occurred on $\{10\bar{1}0\}$ planes and
occasionally on $\{10\bar{1}1\}$. Activity on the $\{10\bar{1}1\}$ planes was
greater at 500°C than at room temperature. No twinning
was observed at 500°C. Investigations of the fracture and
recrystallization of titanium are still in the preparatory
stage. Reviews of the literature have been completed, and
materials and equipment obtained. (auth)

4977

METALLOGRAPHY OF LIGHT METALS. [PART] 5. THE
STRUCTURE OF EXTRUSION PRESS MATERIALS. Hans
Kostron and Margarete Schippers. Translated from Metall
7, 25-9(1953). 8p. (AEC-tr-1793)

4978

METALLOGRAPHIC OBSERVATIONS ON CELL FOR-
MATION AND DEVELOPMENT IN ALUMINIUM. J. W.
Kelly and R. C. Gifkins (Univ. of Melbourne, Australia).
J. Inst. Metals 82, 475-80(1954) June.

Features associated with the cell sub-structure in high-
purity aluminum have been examined by a number of
microscopical techniques and by the x-ray back-reflection
method. The scope and sensitivity of the techniques have
been critically examined. Fine- and coarse-grained speci-
mens were deformed at various rates and at various tem-
peratures up to 325°C. The white-line pattern obtained by
narrow-pencil illumination with the microscope out of focus
does not appear to give an unambiguous indication of cell
boundaries, particularly at low rates of strain at the higher
temperatures. Etch-pits did not delineate either boundaries
of cells or the sub-structure of polygonized single crystals,
whereas deep etching did. Examination of specimens re-
polished and anodized at various states of deformation
showed that in a significant proportion of grains, in both
coarse- and fine-grained specimens, kink and deformation
bands formed first across the whole grain and then broke
down with the development of cells, both along and across
the bands. This also occurred at 300°C., when slip could
not be detected with the phase-contrast microscope, but
cell-boundary migration often took place rapidly during
small strain intervals at 300°C., and tended to mask the
banded structure. At extensions up to 20% there was no
evidence of relative movement of cells, but there was some
tilting, and their orientation differences progressively in-
creased. These observations are discussed in relation to
recent models for deformation during creep. (auth)

4979

METHODS FOR DETERMINING THE LIQUIDUS POINTS OF
TITANIUM-RICH ALLOYS. W. Hume-Rothery and D. M.
Poole (Oxford Univ., England). J. Inst. Metals 82, 490-2
(1954) June.

Two methods are described for determining the liquidus
points of alloys of titanium or other metals which are too
reactive for the use of conventional thermal analysis. In
one method, the alloy is first prepared in an argon-arc
furnace, and small specimens, in titanium containers, are

heated to successive temperatures and quenched. Microscopical examination will then usually permit distinction between specimens quenched from the totally liquid or partly liquid field, and the liquidus point of a titanium-nickel alloy has been determined as lying within a temperature bracket of 4°C. In the second method, specimens of varying composition are quenched from a fixed temperature in a container whose composition lies on the solidus curve at the temperature concerned. The liquidus point is thus determined by a composition bracket, and the totally and partly liquid specimens are distinguished both microscopically, and by the fact that the container is attacked much more rapidly when the totally liquid field is reached. (auth)

4980

ISOTHERMAL TRANSFORMATIONS OF HYPO-EUTECTOID ALUMINIUM BRONZES. R. Haynes (Univ. of Sheffield, England). J. Inst. Metals 82, 493-6(1954) June.

A binary hypo-eutectoid copper-aluminum alloy and similar alloys containing small amounts of nickel have been transformed isothermally in the range 350°–560°C, and the results have been plotted as time/temperature/transformation diagrams. The course of the transformations is described, and the mechanism of formation of the cellular eutectoid is discussed. Nickel has little effect on the rates of transformation, but 3% nickel results in the formation of a double knee in the curve representing the start of the eutectoid reaction. An ordered martensitic phase is ordered when the high-temperature phase, β, is quenched. Neither a microstructural change associated with an ordering reaction, nor the temperature at which martensite first forms, has been detected in the range 560°–350°C. (auth)

4981

A PRESSURIZED HIGH-TEMPERATURE DEBYE-SCHERRER CAMERA, AND ITS USE TO DETERMINE THE STRUCTURES AND COEFFICIENTS OF EXPANSION OF γ- AND δ-MANGANESE. Z. S. Basinski and J. W. Christian (University of Oxford). Proc. Roy. Soc. (London) 223, 554-60(1954) May 20.

A new, pressurized high-temperature Debye-Scherrer camera is described. The structures of γ- and δ-manganese are found to be face-centered cubic, and body-centered respectively. Accurate curves of lattice spacing against temperature are given for both these phases, and also for the β-manganese phase, and the transition temperatures agree well with other determinations. The mean values of the linear coefficients of thermal expansion of the phases over their regions of stability, and the volume changes resulting from the transformations are evaluated. (auth)

PHYSICS

4982

Atomic Energy Research Establishment, Harwell, Berks (England)
THE PREPARATION OF THIN ALPHA SOURCES BY VACUUM SUBLIMATION. J. Milsted. Feb. 1954. 13p. (AERE-C/R-1379)

A convenient apparatus for the preparation of thin α sources for pulse analysis or alpha spectrometry by the sublimation of the oxides from a tantalum filament at temperatures of about 2000°C in a high vacuum is described. It was used for the preparation of sources containing isotopes of all elements from thorium to curium inclusive. When

operated under these conditions, no fractionation effects were observed. The sources prepared gave uniformly good resolution. (auth)

4983

Brookhaven National Lab.
QUARTERLY PROGRESS REPORT [FOR] JANUARY 1–MARCH 31, 1954. (UNCLASSIFIED SECTION). 65p. (BNL-289)

Unclassified research projects are reported, together with abstracts for those activities to be reported concurrently in scientific journals. Operation of the Cosmotron is being improved by various component modifications, in order to achieve a more intense 3-bev beam. Preliminary results are discussed from experiments associated with the Cosmotron. The energy spectrum of π mesons produced by 2.2-bev protons on Be is such as to favor double-meson production to the extent of virtually excluding single-meson production. Total p-p cross sections increase from 27 mb at 410 Mev to 48 mb at 830 Mev. A measured value of 47 mb at 1275 Mev indicates a general flattening of the curve at this level. The polarization of 300-Mev protons by nuclei has been successfully explained in terms of a spin-orbit coupling potential for the scattered proton whose depth is of the order of 10 Mev. Calculations based on an optical model of Be predict a polarization of 60% at a scattering angle of 14°, a result which is in good agreement with experiment. Design of the electron analog has been completed. The solid-state polymerization of acrylamide has been further investigated. Gamma-ray intensities between 93,000 and 435,000 r/hr indicate that the polymerization rate is dependent upon intensity to the 0.75 power and that monomer dependence is between 0 and $\frac{1}{2}$ power. Preliminary data are presented for the heat transfer characteristics from staggered tubes to cross-flowing Hg. Measurements of the heat transfer coefficient were made with chrome-plated and Cu tubes. Brief descriptions of a fast 10-channel analyzer, a survey meter, a magnetic field gradient plotter, a differential pressure micromanometer, and a balanced ionization chamber are presented. Liquid wastes disposed from BNL for the month of Jan., Feb., and Mar., 1954 are tabulated. Pituitary tumors have been radioinduced in castrated male mice. Radiation alone produced no effects, giving radiation an essential but nonspecific role in tumor production. Projects of the medical department are reported on the virulence of irradiated type III pneumococci, the sensitivity of mice to anaphylactic shock after γ radiation, the absorption and metabolism of glycerides and lysine in rats, the development of a chromatographic separation method for the assay of cholinesterases, radio-potassium kinetics in the circulation of a dog, bone cancer treatment with Ga^{72}, and the effects of pH on Na and K transport across the human red cell membrane. (For preceding period see BNL-270.) (K.S.)

4984

Syracuse Univ.
SOME STUDIES OF THE DIFFUSION OF HYDROGEN THRU PALLADIUM. P. A. Silberg and C. H. Bachman. June 24, 1954. 10p. Contract DA-30-115-ORD-331, Technical Report No. 1. (NP-5223)

4985

Naval Research Lab.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. PROGRESS REPORT NO. 9 [FOR] FEBRUARY 1 TO APRIL 30, 1954. B. E. Walker, C. T. Ewing, and D. D. Williams. May 28, 1954. 12p. (NRL-Memo-312)

Heat capacity measurements on salt "A" have been carried to near 700°C. Some difficulties have been experienced in containing the salts in stainless steel at high temperatures.

Monel metal is now under study for this purpose. The radial heat exchange apparatus has shown severe and unexplained corrosion of the nickel unit. The corrosion developed without the addition of salts and to an extent that rendered the apparatus unusable. Viscosity measurements on the salts are contemplated and apparatus is being designed. The salts with high vapor pressure will be difficult to measure in any viscosity apparatus. Other container metals will be examined with fused hydroxide. (auth)

4986

Oak Ridge National Lab.
PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MARCH 10, 1954. J. L. Fowler and E. O. Wollan, eds. July 2, 1954. 60p. Contract W-7405-eng-26. (ORNL-1705)

High-Voltage Physics. The polarization of the $Li^7(p,n)Be^7$ neutrons has been investigated with both carbon and oxygen as analyzers, and of the $T(p,n)He^3$ neutrons with an oxygen analyzer. The differential cross section for the scattering of fast neutrons by nitrogen has been measured at several neutron energies below 1.54 Mev. Three of the neutron energies were between resonances, and the corresponding differential cross sections were essentially isotropic. One of the neutron energies corresponded to a resonance, and for these resonant neutrons the differential cross section showed forward scattering. Further studies have been made on the energy levels in the Be^8 and Be^9 nuclei by bombarding the lithium isotopes with He^3. Cross sections for the production of tritium have been measured by means of the activation technique described in an earlier report. Results are given for the $Li^7(d,t)Li^6$ and $Li^6(d,t)Li^5$ reactions with the additional inclusion of the $Li^7(n,t)He^5$ reaction. Electromagnetic excitation of nuclei by means of the coulomb field of charged particles has been employed to study low-lying states in Ta^{180}, Au^{197}, Tl^{205}. Proton-capture gamma-ray spectra have been studied with a 3×3 in. NaI crystal. It has been possible to resolve the 16- and 12-Mev gamma rays from $B^{11}(p,\gamma)C^{12}$ and to observe how the modes of decay corresponding to these two gamma rays depend upon energy. Radioactivity and Nuclear Isomerism. The angular correlations of gamma rays in cascade have been measured for certain excited states in Nd^{144}, Ba^{134}, Lu^{175}, Cs^{133}, and Eu^{153}. The angular correlation of the 54-kev x ray from ϵ-capture in Hf^{175} and the 342-kev gamma ray in Lu^{175} has also been measured. New data for the attenuation of the polonium—beryllium 4.44-Mev gamma rays in lead and in aluminum and of the Cs^{137} gamma rays in water are presented. An analysis of previously reported data gives close agreement with absorption coefficients given by NBS and with build-up factors calculated by NDA. Neutron Diffraction. The ferromagnetic properties of iron have been studied up to 1000°C. Diffraction studies at temperatures ranging from 300 to 4°K on a series of mixed perovskite-type compounds, $(La,Ca)MnO_3$, show ferromagnetic properties over part of the composition range and several types of antiferromagnetic structures and mixtures of ferro- and antiferromagnetism over other composition ranges. Several silicides of transition elements which had been predicted to be antiferromagnetic were found to show no measurable magnetic scattering. Low-Temperature Physics. The specific heat of anhydrous manganous chloride has been measured from 1.3 to 4.2°K. Heavy-Ion Physics. Investigations of electron capture and loss by heavy ions passing through gases have been continued. Neutron Physics. The spin of the neutron is $\frac{1}{2}(b/2\pi)$, as demonstrated in a magnetic resonance experiment. Theoretical Physics. Brief statements are made regarding some reaction-theory problems involving resonance polarization, maximum values of reaction cross sections, and spectrum shapes. A calculation of the oscillation frequencies of charged particles in axially symmetric electrostatic fields is presented. (For preceding period see ORNL-1620.) (auth)

4987

Radiation Lab., Univ. of Calif., Berkeley
THE EFFECTS OF AGITATOR GEOMETRY IN THE MIXING OF LIQUID—LIQUID SYSTEMS. J. L. Fick, H. E. Rea, and T. Vermeulen. Apr. 1954. 54p. Contract W-7405-eng-48. (UCRL-2545)

The effectiveness of mixing of two immiscible liquids may be expressed in terms of the interfacial area per unit volume of mixture. With four-bladed flat-paddle impellers of various proportions, in cylindrical tanks with "standard" baffling, the specific interfacial area is given by

$$A = \frac{72N^{1.2}L^{0.8}\bar{\rho}^{0.6}\phi}{\sigma^{0.6}f_\phi},$$

confirming earlier work The area is independent of impeller width over the range of the dimensionless ratio W/L from 0.133 to 0.65. This value of A is a maximum and may be reduced by coalescence. In unbaffled tanks with other conditions the same, the specific area has been found to be approximately two-thirds the area in baffled tanks. Power requirements for agitation of the systems studied are essentially the same as for a single liquid of equal mean density. The ratio of power in baffled and unbaffled vessels is about 3.2. Power requirements are found to be proportional to impeller width. The width used must be sufficient to produce bulk homogeneity of mixing. Mixing index as a measure of homogeneity is redefined, and its dependence on physical properties and geometrical variables is explored. (auth)

4988

ON THE BOSE-EINSTEIN LIQUID MODEL FOR LIQUID HELIUM. II. PROPERTIES UNDER HIGH PRESSURES. Ziro Mikura (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Japan) 11, 207-12(1954) Feb.

The excitation energy in the "modified Bose-Einstein liquid" model is assumed to be proportional both to the number density of He^4 particles and to the one third power of the particle mass. In a previous paper, many properties of the He^3- He^4 liquid mixture were accounted for by using this model, assuming a particle mass independent of He^3 concentration. This model is shown to be successfully applied to the case of pure liquid He^4 under high pressures. The values of parameters (the excitation energy and the particle mass), which are chosen so as to reproduce the correct lambda-temperature corresponding to the pressure concerned, are found to be of the correct magnitude to explain the experimental pressure dependences of second sound velocity and of the entropy on the lambda-curve. A noticeable fact is that the increase in the value of the particle mass due to pressure is almost exactly proportional to pressure. (auth)

4989

FILM FLOW IN LIQUID HELIUM II AT LOW LEVEL DIFFERENCES. Gerald S. Picus (Institute for the Study of Metals, Univ. of Chicago, Illinois). Phys. Rev. 94, 1459-67(1954) June 15.

Observations of the flow of the liquid helium II film have been made at very low level differences. To produce the flow a plunger is displaced vertically at an accurately controlled rate inside of a breaker of internal diameter of about one centimeter. By this means the initial behavior when flow is started, the eventual steady-state behavior, and the oscillations around the final equilibrium position after the plunger is stopped, are observed. The results obtained fit the form of equations derived by Atkins if, in addition, the existence of an upper limit to the velocity of

flow is postulated. However, the period of the final oscilla-
tions is always found to be shorter than that deduced from
the initial effects. The final periods also vary more slowly
with temperature and more rapidly with the total length of
the helium film than do the initial periods. Assuming the
film thickness d varies with height h according to a relation
$d = D/h^n$, we find from the initial periods that $n \cong \frac{1}{2}$ and
from the final oscillations $n \cong 1$. D, the thickness at a
height of one centimeter, is approximately 2.5×10^{-6} cm,
somewhat smaller values being obtained from the initial
periods than from the final periods. These results are
taken as evidence for the existence of a difference between
the moving and the stationary film. Various mechanisms
for producing the necessary redistribution of the material
of the film, if this difference is simply a change in shape,
are discussed. (auth)

4990

THE PROBLEM OF LIQUID HELIUM. SOME RECENT
ASPECTS. J. G. Daunt and R. S. Smith (Ohio State Univ.,
Columbus). Revs. Mod. Phys. **26**, 172-236(1954) Apr.

AEROSOLS

4991

Illinois Univ. Engineering Experiment Station
PROPERTIES OF ELECTRICALLY CHARGED AERO-
SOLS. TECHNICAL REPORT 12. H. F. Kraemer. Mar.
31, 1954. 90p. Contract AT(11-1)-276. (COO-1013)

A fundamental study has been made of the deposition of
particles on stationary spherical and cylindrical obstacles
from a moving aerosol stream in the presence of electro-
static forces. Theoretical equations were derived for the
amount of aerosol deposited. The deposition of homogeneous
dioctyl phthalate aerosol on a spherical collector was
measured experimentally with various combinations of
charged and uncharged collector and aerosol particles. The
results are presented graphically. Within the accuracy of
the analytical methods used to measure deposition, the
experimental results agree with those predicted by the
theory. As a result of the investigation, two new types of
dust collection equipment are proposed. (auth)

ELECTRICAL DISCHARGE

4992

OPTICAL INVESTIGATIONS OF DISCHARGES IN METAL
VAPOURS. PART 4. THE ABSOLUTE CONCENTRATION
OF EXCITED ATOMS IN A LOW-PRESSURE MERCURY
DISCHARGE. V. A. Fabrikant, F. Butaeva, and I. Tsirg
[Zirz]. Translated from Physik. Z. Sowjetunion **11**, 576-89
(1937). 9p. (AERE-Trans-11/3/5/313)

Absorption measurements were used to determine the
concentrations in which atoms appear in the levels
$6^3P_{0,1,2}(10^{11}$ to 10^{12} atoms per cc) in a discharge tube at
pressures of 10^{-4} to 10^{-2} mm of Hg and with a current
intensity of 3 amp. It was ascertained that the conditions
of discharge were far from the state of temperature
equilibrium. It was also found that the distribution of the
atoms between the levels $6^3P_{0,1,2}$ corresponded to the ex-
citation functions which Penney has calculated for these
levels. In contrast to photoexcitation, the highest concen-
tration occurs in the highest level, 6^3P_2. (auth)

4993

OPTICAL INVESTIGATION OF THE DISCHARGE IN
METALLIC VAPOURS. 1. THE RELATION BETWEEN
THE CONCENTRATION OF EXCITED ATOMS AND THE
CURRENT INTENSITY IN A HIGH PRESSURE MERCURY
DISCHARGE. (Optische Untersuchung Der Entladung in
Metalldampfen I Die Abhangigkeit Der Konzentration
Angeregter Atome Von Der Stromstärke In Der

Hochdruckquecksilberentladung). V. A. Fabrikant and
[V.] L. Pulver. Translated from Physik. Z. Sowjetunion **6**,
521-36(1934). 11p. (TIB/T4133A)

The absorption and intensity of visible lines in a high-
pressure discharge were measured, with constant concen-
tration of the Hg vapor, for various current intensities
using $Hg-A$ lamps with oxide cathodes. Constant absorp-
tion and linear increase in the intensity of the visible triplet
with increasing current intensity were established. The
results showed that the concentrations of atoms at the levels
2^3P_0, 2^3P_1, and 2^3P_2 are related to each other in the propor-
tion 100 to 144 to 120 and remain constant for variations in
the current intensity from 5 to 7.5 amp. (J.A.G.)

4994

OPTICAL INVESTIGATIONS OF THE DISCHARGE IN
METALLIC VAPOURS. 2. THE REABSORPTION OF
RADIATION IN A MERCURY DISCHARGE. (Optische
Untersuchungen Der Entladung In Metalldampfen). 2.
Über Strahlungsreabsorption in Der Quecksilberentladung).
V. A. Fabrikant and F. Butaeva. Translated from Physik.
Z. Sowjetunion **9**, 383-404(1936). 15p. (TIB/T4133B)

The assumption that only reabsorption can influence the
intensity relationships of the mercury lines with common
upper levels is discussed. It is shown that all observed
intensity relationships can be qualitatively explained by the
influence of reabsorption. The lower limits for the re-
absorption coefficients of the individual lines are deter-
mined. It is shown that the results agree qualitatively with
the thermal theory of mercury discharge at high pressures.
(auth)

4995

OPTICAL INVESTIGATIONS OF THE DISCHARGE IN
METALLIC VAPOURS. 3. THE INFLUENCE OF THE
PRESSURE ON THE RADIATION FROM DISCHARGES IN
MERCURY AND CADMIUM VAPOUR. (Optische
Untersuchungen Uber Entladung In Metalldampfen. 3.
Einfluss Des Druckes Auf Die Ausstrahlung Bes Entladungen
in Quecksilber Und Kadmiumdampf). V. A. Fabrikant,
A. S. Kanel, and F. Butaeva. Translated from Physik Z.
Sowjetunion **10**, 315-36(1936). 13p. (TIB/T4133C)

It is established that the intensities of the lines of
mercury and cadmium discharge spectra vary nonmonoto-
nously in relation to the pressure. A characteristic feature
is the existence of an intensity minimum at a particular
pressure. By comparing the measured results for lines
with either an upper or lower common level, the part
played by the reabsorption and the excitation potential
could be explained. In addition, an alteration in the form of
the curve for the angular distribution of the intensity was
established with rising pressure. It could be shown that all
the observed effects agreed well with simple theoretical
estimates. (auth)

ELECTRONS

4996

High-Energy Physics Lab., W. W. Hansen Labs. of Physics,
Stanford Univ.
ELECTRON-INDUCED SHOWERS. Asher Dale Kantz. May
1954. 99p. Sponsored by ONR and AEC under Contract
N6onr 25116. (HEPL-17)

The Stanford Linear Accelerator was used as a source of
high-energy (185 Mev) monoenergetic electrons for the study
of radiation—materialization mechanisms responsible for
electron shower production. Energy loss distributions, both
radial and longitudinal, were studied in C, Al, Cu, Sn, and
Pb. A total absorption spectrometer was used for the
measurements. (K.S.)

INSTRUMENTS

4997

Bell Telephone Labs., Inc.
FIRST QUARTERLY ENGINEERING REPORT ON FEASI-
BILITY STUDY OF TRANSISTOR AIRBORNE DIGITAL
COMPUTER (TRADIC). REPORT NO. 21536-1. Feb. 15,
1953. 176p. (AD-8604)

4998

DuPont de Nemours, E. I., and Co. Explosives Dept.,
Atomic Energy Div.
A LIGHT SOURCE FOR TESTING PHOTOMULTIPLIER
TUBES. F. E. Kinard and J. S. Stutheit. Mar. 1954. 25p.
Contract AT(07-2)-1. (DP-42)

A light-source tester for photomultiplier tubes was
developed which gives a relative measure of tube resolution
and gain without dependence on scintillation crystals or
gamma sources. (auth)

4999

Phillips Petroleum Co., Atomic Energy Div.
MODIFICATION OF REACTOR INSTRUMENTS COM-
PENSATED ION CHAMBER POWER SUPPLY. K. A.
McCollom. Dec. 10, 1952. Decl. Jan. 15, 1954. 9p.
Contract [AT-(10-1)-205]. (IDO-16041)

The period channel of the Materials Testing Reactor
exhibited such wide fluctuations from the average value of
the period, at times, that false "period" scrams were
obtained which would shut down the reactor. These fluctua-
tions were undesirable, since they were not an indication of
rate of change of neutron flux. Three changes in the reactor
control circuitry eliminated these undesirable fluctuations
to such an extent that there have been no false "period"
scrams since their installation. (auth)

5000

A CURRENT STABILIZED PHOTOMULTIPLIER POWER
SUPPLY. P. Fellgett (Univ. of Cambridge, England).
J. Sci. Instr. 31, 217-19(1954) June.

Tests are described on a two-valve stabilizer for the
accelerating voltages applied to a photomultiplier. A
voltage stability of one part in 10^4 is found for the circuit.
(auth)

MASS SPECTROGRAPHY

5001

American Cyanamid Co. Atomic Energy Div., Idaho Falls,
Idaho
THE INGHRAM MASS SPECTROMETER. N. E. Van Sickle.
Aug. 14, 1953. Decl. Jan. 14, 1954. 11p. (IDO-15080)

The Inghram mass spectrometer or the ANL-MA15 mass
spectrometer is a 12 radius, 60 degree sector, surface
ionization type instrument capable of resolving the ions of the
various isotopes of uranium and oxygen when combined as
UO_2. This requires the separation and identification of ions
differing in weight by only one mass unit. The major units
are listed, and operating characteristics are discussed.
(auth)

5002

CURRENT CARRYING DEFLECTOR-PLATES FOR RO-
TATING A BEAM OF CHARGED PARTICLES. P. A.
Einstein and A. G. Edwards (Associated Electrical In-
dustries Ltd., Aldermaston Berks, England). J. Sci. Instr.
31, 222-3(1954) June.

The proposed method serves to eliminate aberration in
mass spectrometers resulting from misalignment of the
collector unit. The band-shaped beam is passed along the
mid-plane of a pair of deflector plates consisting of some
low-conductivity material, through which currents are
passed perpendicular to the beam axis and in opposite
directions. The desired rotation can be achieved by adjust-
ing voltages, plate lengths, distances, etc. (L.M.T.)

MATHEMATICS

5003

Los Alamos Scientific Lab.
CHARACTERS OF THE SYMMETRIC GROUP OF DEGREE
15 AND 16. Robert L. Bivins, N. Metropolis, Paul R.
Stein, and Mark B. Wells. May 28, 1954. 10p. Contract
[W-7405-eng-36]. (AECU-2898)

Relevant properties of symmetric group characters are
discussed in relation to the problem of calculating the
characters of degree 15 and 16 on an electronic computer
(MANIAC). It is pointed out that the practical difficulties
encountered by recursive solutions and hand computation
are largely overcome by electronic machines, and the suc-
cess encountered by this approach indicates a wide applica-
tion of computer techniques to a large class of complicated
problems in algebra and group theory. The values obtained
from this project have been microfilmed directly from the
computer tape, and are available from the journal
Mathematical Tables and Aids to Computation. (K.S.)

MEASURING INSTRUMENTS AND TECHNIQUES

5004

Northwestern Univ.
STUDIES OF THE $Li^6(n,\alpha)H^3$ REACTION WITH NUCLEAR
EMULSION. FINAL REPORT. James H. Roberts. Dec.
21, 1953. 14p. Contract AT(11-1)-66. (AECU-2890)

Neutron detection in nuclear emulsions, using the
$Li^6(n,\alpha)H^3$ reaction, is discussed. The emulsion is prepared
by introducing Li glass specks of 1 to 5 μ in diameter
suspended in absolute alcohol. Differential capture cross
sections and the probable number of tracks per radian
were measured for a neutron-triton angle of 0 to 180°, at
neutron energies of 1.1, 1.5, and 2.0 Mev. Four different
types of neutron sources are considered in discussing the
value of this reaction for the study of neutron spectra.
(K.S.)

5005

Notre Dame Univ.
THE FERROUS SULFATE RADIATION DOSIMETER. A
CALORIMETRIC CALIBRATION WITH GAMMA RAYS.
R. M. Lazo, H. A. Dewhurst, and Milton Burton. [1953]
16p. Contract AT(11-1)-38. (AECU-2893)

The ferrous sulfate radiation dosimeter was recalibrated
by a calorimetric method in which assumptions regarding
energy absorbed in the glass and the heat capacity of the
calorimeter have been eliminated. The 100 ev yield,
$G(Fe^{++} \rightarrow Fe^{+++})$, is 15.8 ± 0.3 for Co^{60} gamma radiation
in agreement with the Hochanadel-Ghormley value. The
result is compared with other G values obtained by other
methods and it is recommended that the low value be
adopted for Co^{60} gamma radiation and for electrons in the
1- to 2-Mev range. (auth)

5006

Kansas Univ. Graduate School
VARIABLES AFFECTING THE COUNTING OF C^{14} IN THE
LIQUID PHASE WITH A GEIGER-MUELLER TUBE.
PART 1. DETERMINATION OF VAPOR-LIQUID
EQUILIBRIA OF A TERNARY MIXTURE WITH A RADIO-
ACTIVE TRACER. PART 2 (thesis). Ted Tibor Szabo.
Apr. 1953. 98p. (AECU-2897)

5007

Los Alamos Scientific Lab.
ZnS(Ag) PHOSPHOR MIXTURES FOR NEUTRON SCINTIL-
LATION COUNTING. P. G. Koontz, G. R. Keepin, and J. E.
Ashley. [1954] 23p. Contract [W-7405-eng-36]. (AECU-
2913)

Various zinc sulfide phosphor mixtures for neutron
scintillation counting have been compared. Selected com-
pounds of hydrogen, lithium, boron, and fissionable elements

were mixed in varying proportions with ZnS(Ag), and the corresponding neutron and gamma counting efficiencies measured as functions of energy. The low sensitivity of these mixtures to gammas (10^{-5} to $10^{-4}\%$) and the measured short time decay constant ($\tau = 0.04$ μsec) offer distinct advantages for fast neutron counting. (auth)

5008

Hanford Works
A CONTINUOUS AIRBORNE ALPHA CONTAMINATION ALARM AND RECORDER. C.L. Pleasance, T. R. Cartmell, and John F. Gifford. June 30, 1953. Decl. Jan. 15, 1954. 31p. Contract W-31-109-eng-52. (HW-26503)

Development of an instrument that will continuously record the instantaneous alpha activity in air and give an alarm if this activity rises to a predetermined level is reported. The system is also adaptable to airborne beta-gamma detection. Details of construction and cost factors are included. (auth)

5009

Phillips Petroleum Co., Atomic Energy Div.
ROUTINE MEASUREMENT OF GAMMA INTENSITY. Calvin H. Hogg. Nov. 2, 1953. Decl. Jan. 15, 1954. 7p. Contract AT(10-1)-205. (IDO-16129)

An instrument for measuring the gamma intensity in the MTR gamma facility by means of the heat generated in a rod-type calorimeter is described. The instrument utilizes the temperature difference, produced by gamma heating, between the ends of a solid cylinder insulated so that most of the heat escapes through one end. A calibration curve is included. (auth)

5010

Phillips Petroleum Co., Atomic Energy Div.
MTR CRYSTAL SPECTROMETER DATA PRINTING SYSTEM. G. L. Smith and L. G. Miller. June 23, 1954. 19p. Contract AT(10-1)-205. (MTR-L-54-42)

Operating automatically, the MTR Crystal Spectrometer can accumulate up to 1500 separate counting measurements with 0.3 per cent statistics in a week-end period. This imposes a serious data handling problem. A data printing system using glow-transfer counters and an electric type-writer has been installed to replace the commercial scaler and traffic counter system. The 1-μsec scaler has scales of 1 to 16 preceding the 6 glow-transfer counters. After a count, a motor driven scanning switch connects the 10 points of each glow-transfer tube simultaneously through triode-operated relays to the solenoid actuators of the 10 numbers on the typewriter. Only the point having the glow discharge will record. The system will handle up to 10^6 cpm and print digits without the attendant short lifetimes of electric reset registers and traffic counters. In addition, the scaling factor, time, crystal position, arm angle, and sample wheel position are printed on folded and perforated teletype sheets which are later bound to form a permanent record. A special spacing is used which permits calcula-tions to be made on the data sheets without data transfer. (auth)

5011

Radiation Physics Lab., National Bureau of Standards
ENERGY DEPENDENCE AND DIRECTIONAL DEPEND-ENCE OF THE DT-60 SILVER PHOSPHATE GLASS DOSIMETER. Frank H. Attix and William H. Hayes. July 29, 1952. 23p. (NBS-1829; AD-20001)

Information is presented in connection with the spectral response and directional dependence of the DT-60/PD Ag_3PO_4 glass dosimeter. The dosimeter fluorescence meas-urements reported were made after 12 hr or more had elapsed following exposure in order to minimize errors caused by rise time of the fluorescence in the glass. Pre-

production dosimeters submitted by Polaroid, were about 65% more sensitive to radiation of 150 Kev than to γ rays emitted by Co^{60}. A comparison between the curves for energy dependence of 8% Ag_3PO_4 glass of Corning melt no. 23 and of the DT-60 dosimeter with Pb shielding shows that the energy dependence of the Polaroid preproduction models was considerably less than the inherent energy dependence of the glass itself. Efforts were made to modify the Pb filters on the front and back faces of the glass squares in the dosimeter case. The density of the Pb used for the filters was 11.3 g/sq cm. Various com-binations of hole size and Pb thickness were tried; a 0.045-in. Pb thickness with a no. 36 drill hole (0.107 in. in diam.) was the most promising. Graphs are included which show the variations in energy dependence for several thick-nesses of Pb. The dependence of the chamber upon relative direction of incident radiation of 100-Kev effective energy was also determined. The configuration of the Pb filters was the most important cause of anisotropism; radiations of higher energies should penetrate the Pb more easily and reduce the effect. (auth)

5012

Department of Mines and Technical Surveys. Mines Branch (Canada)
A RADIATION MONITOR FOR A CONTINUOUS ORE-HANDLING SYSTEM. J. C. Baker, A. H. Bettens, C. Lapointe, and G. G. Eichholz. Mar. 1, 1954. 21p. (NP-5228; TR-115/54)

A radiation monitor for conveyors carrying low-grade or waste uranium ore is described. The unit uses a cylindrical scintillation detector with a liquid phosphor, and the radia-tion level is indicated by means of a ratemeter and a cold-cathode tube scale of 1000 driving a mechanical register. (auth)

5013

Department of Mines and Technical Surveys, Mines Branch (Canada)
NOTE ON THE ADAPTATION OF SCALERS AND AMPLI-FIERS FOR USE WITH THE EQUILIBRIUM COUNTER ASSEMBLY. G. E. Alexander and G. G. Eichholz. May 17, 1954. 7p. (NP-5238; TR-119/54)

Some modifications are described in the pre-amplifier circuit of the Marconi detector assembly and in the Electronic Associates scaler type SC-3T to adapt them for combined use in an equilibrium (beta-gamma) assay unit. (auth)

5014

Radiation Lab., Univ. of Calif., Berkeley
50-CHANNEL PULSE-HEIGHT ANALYZER ACCELERATOR TYPE. MAINTENANCE MANUAL. Robert E. Heller. Dec. 15, 1953. 58p. Contract W-7405-eng-48. (UCRL-2430)

5015

DEAD-TIME LOSSES IN MULTICHANNEL COINCIDENCE SYSTEMS. J. S. Kirkaldy (McGill Univ., Montreal, Canada). Can. J. Phys. 32, 406-15(1954) June.

Correction formulae for the counting losses due to dead times in multichannel coincidence systems are de-rived for conditions of significant interchannel cor-relation and for both continuous and pulsed sources of counts. The dead times are assumed to be either "extend-ing" (following all counts) or "nonextending" (following only recorded counts). The corrections for the effects of a finite coincidence resolving time are also evaluated. The approximations used are shown to be valid when the fractional losses are less than 40%, by comparison with the results of a previous experimental paper. The cor-rections are most likely to be required in the case where the source is intermittent, as from a pulsed accelerator, so that the instantaneous counting rates are

very high during the pulse, and where the coincidence rate is of the same magnitude as the noncoincident rates, as in a well shielded coincidence telescope. (auth)

5016

AN ABSOLUTE TISSUE DOSEMETER FOR FAST NEUTRONS. G. S. Hurst (Oak Ridge National Lab., Tenn.). Brit. J. Radiol. 27, 353-7(1954) June.

It is shown that the Bragg-Gray principle can be applied to proportional counter designs in such a manner that the absolute tissue dose (and hence the flux if the energy spectrum is known) due to fast neutrons can be measured. The method has the combined advantages of high sensitivity to fast neutrons and very low sensitivity to γ radiation. Two practical designs are described. (auth)

5017

A RADIUM ALARM SYSTEM. H. Besford (Queen Elizabeth Hospital, Birmingham, England). Brit. J. Radiol. 27, 362-4 (1954) June.

Design and circuit diagram are presented for a radiation detector equipped with an alarm system which was designed to automatically monitor soiled hospital linen for the presence of radium. (C.H.)

5018

DETERMINATION OF THE MASS OF CHARGED PARTICLES IN NUCLEAR EMULSIONS BY ENUMERATION OF GAP WIDTHS. Georges Kayas. Compt. rend. 238, 2153-5(1954) May 31. (In French).

Mass determinations in nuclear emulsions are investigated by measuring the number, rather than length, of the unionized gaps along particle tracks. The density of such gaps are defined by their number per unit length, using a magnification of about 1000, and Spencer immersion objective of 97x. It has been previously shown that $G = a_\mu R^n$, where G is the variation in the total number of gaps, R is the length of the track to rest, and a_μ and n are constants which depend on the degree of development and the particle mass. A determination of a_μ and n for known particles as a function of development (grain count/100μ) is made, and from the values of a_μ and n obtained from an unknown plate, the particle mass is determined. (K.S.)

5019

A TWO-CRYSTAL GAMMA-RAY SCINTILLATION SPECTROMETER. D. H. Peirson (Atomic Energy Research Establishment, Harwell, Berks, (England)). Nature 173, 990-1(1954) May 22.

A two-crystal spectrometer in which the γ source is exposed simultaneously to NaI and anthracene scintillation counters is described. The Compton continua from the 2 crystals are equalized in height (counting-rate scale) and extent (energy scale) and then subtracted in suitable counting-rate circuits, so that each γ-ray energy is represented only by a photoelectric peak in the recorded spectrum. The method has the advantage of allowing good geometry and a high sensitivity with no loss in resolution. (J.A.G.)

5020

PRECISION ALPHA-PARTICLE COUNTING. K. M. Glover and G. R. Hall (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 173, 991-2(1954) May 22.

Methods of absolute α counting at Harwell and at the Radiation Lab. of the Univ. of Calif., Berkeley, are compared. The former used the low-geometry CH_4 proportional chamber. In the chamber used at Berkeley, the α particles were collimated through a path of 40 in. and are detected by a ZnS – Ag phosphor and photomultiplier. Counting results of 3 Pu sources deposited on Pt disks were remarkably good. (J.A.G.)

5021

USE OF DISSOLVED ACETYLENE IN LIQUID SCINTILLATION COUNTERS FOR THE MEASUREMENT OF CARBON-14 OF LOW SPECIFIC ACTIVITY. B. N. Audric and J. V. P. Long (Chemical Research Lab., Teddington, Middlesex, England). Nature 173, 992-3(1954) May 22.

An investigation of the measurement of C^{14} of low specific activity by introducing the sample (C_2H_2 dissolved in a phosphor consisting of 2,5-diphenyloxazole at a concentration of 3 g/l in toluene containing 2% of ethanol) into a liquid scintillation counter is reported. The solution remained clear when cooled to $-78°C$ and readily absorbed more than 100 times its own volume of C_2H_2, with a change in counting efficiency of about 23%. (J.A.G.)

5022

ENERGY TRANSFER IN ORGANIC PHOSPHORS. J. B. Birks (Rhodes Univ., Grahamstown, South Africa). Phys. Rev. 94, 1567-73(1954) June 15.

A quantitative theory is developed of the photofluorescence and scintillation properties of organic materials. On this theory the intermolecular energy transfer occurs by photon emission and absorption; the molecular emission spectrum extends continuously from the ionization energy E_I down to the strong fluorescence band normally observed; the emission of primary photons ~E_I is excited by ionizing radiations; and the subsequent scintillation process consists of a photon cascade, through the emission spectrum. The theory is in agreement with the experimental data on the photofluorescence and scintillations from pure and mixed crystals, and on the scintillations from solutions. It is shown that, because of self-absorption, many of the existing data refer only to the technical fluorescence properties, and a preliminary assessment is made of the molecular properties of the more important organic phosphors. (auth)

5023

A 30 CM DOUBLE FOCUSING MAGNETIC SPECTROMETER WITH AN ANNULAR IRON YOKE. P. H. Stoker, Ong Ping Hok, E. F. de Haan, and G. J. Sizoo (Natuurkundig Laboratorium van de Vrije Universiteit, Amsterdam, Netherlands). Physica 20, 337-49(1954) June.

Theory shows that the highest luminosity in a beta spectrometer at a certain resolution can be obtained, when the field in the equatorial plane at a distance r from the center fulfills the condition

$$H_2(r,O) = [1 - \tfrac{1}{2}\rho + \tfrac{3}{8}\rho^2 - \tfrac{5}{24}\rho^3 + \tfrac{37}{192}\rho^4 - \ldots.]$$

where r_0 is the radius of the principal orbit of the electrons and $\rho = (r - r_0)/r_0$. This is practically identical with a field represented by $H(r) = H(r_0) (r_0/r)^{1/2}$. The equipotential surfaces in a field corresponding with the surface of the pole shoes, have been calculated numerically. A beta spectrometer has been constructed realizing this field. The value of r_0 is 30.0 cm; the maximum transmission 2.8%; using a source of 1.0 cm width the half-value width for a monokinetic electron line was found to be 2.5%. To reduce the stray field an annular yoke is used, surrounding the airgap as well as the coils. The magnetic field is measured by a compensation method. The experimental arrangement is described and the results of some measurements, are given. (auth)

MESONS

5024

Palmer Physical Lab., Princeton Univ.
K-MESON DECAY SCHEME. S. B. Treiman. Palmer Physical Lab. and Naval Ordnance Lab. Feb. 10, 1954. 10p. Contract N6ONR-270-11, Technical Report No. 12. (NP-5224)

The work of Leprince-Ringuet and Rossi, together with recent results from the cosmic-ray group at the Ecole Polytechnique of Paris suggests the possible existence of two classes of K mesons. The decay of one of these classes according to a $K \rightarrow \mu + \gamma + \nu$ scheme is considered on the

basis of a simple theoretical model wherein the K meson is directly coupled to its decay products. It is found that one coupling scheme leads to μ meson and photon spectra that are consistent with the MIT experimental data. (K.S.)

5025

CLOUD-CHAMBER OBSERVATIONS OF SOME UNUSUAL NEUTRAL V PARTICLES HAVING LIGHT SECONDARIES. V. A. J. Lint, C. D. Anderson, E. W. Cowan, R. B. Leighton, and C. M. York, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 94, 1732-5(1954) June 15.

From six cloud-chamber photographs of unusual V^0 decay events, the following conclusions are drawn: (1) there is a neutral V particle that decays into two particles lighter than κ mesons with a Q value too small to be consistent with a $\theta^0(\pi, \pi, 214$ Mev$)$ particle; (2) some of these events cannot be explained in terms of the decay of a $\tau^0(\pi^0, \pi^-, \pi^+, Q \sim 80$ Mev$)$ particle; (3) these events can be explained by any one of a number of three-body decay schemes, but two different types of V particles must be postulated if two-body decays are assumed. (auth)

5026

K-PARTICLE PRODUCTION BY PROTONS OF 2.2 AND 3.0 BEV. R. D. Hill, E. O. Salant, and M. Widgoff (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 94, 1794 (1954) June 15.

Four K particles have been observed from the bombardment of Cu by 2.2-and 3.0-bev protons. At 2.2 bev, one K^- meson formed a star in a nuclear emulsion, consisting of a 50- Mev π meson and a heavy fragment of 600μ range. The mass of this particle was 970 ± 150 m_e, and it is estimated that the meson left the target with an energy of 270 Mev. At 3.0 bev, three tracks due to stopping heavy mesons were found, each producing a single minimum ionizing particle with no visible recoil or electron track. It is concluded that these particles were K mesons of mass in the range 1050 ± 250 m_e, and their energies leaving the target were between 90 and 130 Mev. All K events observed indicate a life at least 2×10^{-9} sec before coming to rest. (K.S.)

NEUTRONS

5027

THE DESIGN OF COLD NEUTRON FILTERS. P. A. Egelstaff and R. S. Pease (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 31, 207-12 (1954) June.

The problems of designing cold neutron filters are surveyed and discussed. Theoretical expressions for the mean wavelengths and fluxes of the cold neutron beams are given. The choice of filter material is discussed and the physical state of the material is shown to be an important factor. Filters using beryllium, magnesium, magnesium oxide, lead and bismuth have been made and their performances tested and compared with theory. (auth)

NUCLEAR PHYSICS

5028

Palmer Physical Lab., Princeton Univ.
PAIRING EFFECTS IN COULOMB ENERGIES AND THE RADII OF MIRROR NUCLEI. B. C. Carlson and I. Talmi. June 17, 1954. 36p. Contract [AT-(30-1)-937, Scope II] (NYO-6576)

The Coulomb energy difference between the nuclei of a mirror pair exhibits an odd-even alternation with Z that is presumed to reflect the well known pairing property of the short-range nuclear forces. By taking second differences of Coulomb energy (differences between successive mirror pairs), the alternation is soon to continue to at least Z = 15, and additional irregularities appear that may be shell

structure effects. The analysis of Feenberg and Goertzel is discussed from the point of view of the shell model, and the pairing of spins is extended to the spherically symmetric pairing characteristic of the state of lowest seniority. A harmonic oscillator model with jj coupling is used to calculate the Coulomb energy, including exchange effects, in the state of lowest proton seniority. The single parameter of the model is determined by comparison with experimental data and remains constant to $\pm 1.5\%$ through the $F_{\frac{7}{2}}$ and $d_{\frac{5}{2}}$ shells. The rms radius of the nuclear charge distribution is calculated by the same model. Between C^{13} and Al^{27}, the equivalent r_0 decreases fairly smoothly from 1.34 to 1.20. For $A \leq 11$ the model is not satisfactory, and for $A \geq 31$ there are some serious inconsistencies in the data. The most recent data indicate that r_0 may decrease to the range 1.1 to 1.15 for $A \cong 39$. (auth)

5029

DEUTERON PHOTODISINTEGRATION AT INTERMEDIATE ENERGIES. J. M. Berger (Case Inst. of Tech., Cleveland, Ohio). Phys. Rev. 94, 1698-1713(1954) June 15.

The differential and total cross sections for the photodisintegration of the deuteron are calculated for incident gamma-ray energies in the range from 6 to 28 Mev. The following cases are treated: (1) Approximation I, in which shape-independent wave functions are used corresponding to a 50 percent charge-exchange central force, (2) Approximation II-C, in which a central Hulthén potential with a variable percentage of charge exchange forces is used, (3) Approximation II-NC, in which approximate noncentral Hulthén wave functions and an approximate noncentral Hulthén potential with 50 percent charge-exchange force, is used. In all these calculations, use is made (where possible) of a form for the interaction between the deuteron and radiation that gives the results of the interaction to all multipole orders automatically. We also estimate the possible effect of exchange currents on the cross sections by a calculation making use of the phenomenologically derived exchange moments of Berger and Foldy. The numerical results of these calculations are used to estimate the uncertainty in the theoretically calculated cross section at the present time. It is concluded that the uncertainty may be as large as 15 percent of the total cross section for these energies. About 5 percent of this arises from experimental uncertainties in empirically determined parameters, while the remainder arises from ignorance of the exact form of the neutron-proton interaction. (auth)

NUCLEAR PROPERTIES

5030

Los Alamos Scientific Lab.
SPINS OF EXCITED STATES OF SOME ODD A NUCLEI ACCORDING TO THE COLLECTIVE MODEL. Richard L. Moore. [1954] 16p. Contract [W-7405-eng-36]. (AECU-2912)

The energy level spacing of some heavy isotopes of odd A have been examined from the point of view of the collective model of the nucleus to obtain predictions about the level spins. Levels, spins, and rotational energies are estimated for Po^{215}, Ac^{227}, Th^{229}, Pu^{239}, Rn^{219}, Ra^{223}, U^{235}, and Am^{241}. (K.S.)

5031

Phillips Petroleum Co., Atomic Energy Div.
CONTOUR DIAGRAMS OF THERMAL NEUTRON ABSORPTION CROSS SECTIONS. John E. Evans. Apr. 20, 1954. 8p. Contract AT(10-1)-205. (IDO-16163)

5032

Radiation Lab., Univ. of Calif., Berkeley
NUCLEAR INTERNAL MOMENTUM DISTRIBUTIONS (thesis).

John Marsh Wilcox. Apr. 1954. 46p. Contract W-7405-eng-48. (UCRL-2540)

The nuclear internal momentum distributions of protons in light nuclei have been studied with the 340-Mev scattered proton beam from the synchrocyclotron. The two protons from a quasi-elastic scattering event are detected in coincidence, and the energy of one of them is magnetically analyzed. In the limit of the impulse approximation, conservation of energy and momentum can be employed to solve for the momentum of the struck proton. The best fit to the experimental data for beryllium was obtained with a gaussian momentum density distribution with a 1/e value of about 20 Mev. Fermi (rectangular) and Chew-Goldberger distributions did not fit so well. Qualitative differences were observed between lithium, beryllium, and boron. The observed lithium spectrum was interpreted as being caused by two types of protons in lithium: two core protons that have a large momentum distribution and a third proton that has a rather low kinetic energy. This conclusion was supported by the shape of the observed lithium spectrum and by the relative yields from lithium, beryllium, and deuterium. The spectrum observed from beryllium indicated that the protons in beryllium have a larger momentum than the protons in the lighter elements studied. There were some indications that the fifth proton in boron may behave similarly to the third proton in lithium. (auth)

5033

A MODIFIED SHELL MODEL OF ODD-EVEN NUCLEI. A. B. Volkov (Univ. of Wisconsin, Madison). Phys. Rev. 94, 1664-70(1954) June 15.

Certain magnetic interaction data (static magnetic moments and "forbidden" magnetic dipole transitions) are interpreted on the basis of a modified shell model of odd-even nuclei. The nuclear wave function is assumed to be primarily an equally weighted admixture of states formed from all possible odd-particle configurations within the odd-particle open shell of the Mayer-Jensen shell model. These configurations are coupled in a prescribed manner so as to give the total angular momentum and parity of the nucleus. The agreement with the data represents a considerable improvement over the Mayer-Jensen model. (auth)

5034

NUCLEAR ENERGY LEVELS OF Tl^{203}. Jagdish Varma (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 94, 1688-94(1954) June 15.

Using scintillation spectrometry and coincidence counting techniques, Tl^{203}, formed by orbital electron capture in Pb^{203}, has been shown to emit gamma rays of energies 280, 403, and 683 kev. The 403- and 280-kev gamma rays were found to be in sequence; the 683-kev gamma ray represents the associated cross-over transition. By energy and conversion coefficient measurements, it has been shown that the same 280 ± 2 kev level of Tl^{203} is excited in the decay of both Hg^{203} and Pb^{203}. A coincidence method for the measurement of the conversion coefficients of the 403-kev gamma rays is described. The K-shell conversion coefficient of the 403-kev gamma ray has been measured as 0.076, the K/(L + M) ratio being 3.7. The angular correlation function for the 403-kev−280-kev cascade has the form $W(\theta) = 1 - (0.152 \pm 0.007) \cos^2\theta$. For the known multipole mixture of the 280-kev quantum, the correlation measurements indicate the 403-kev transition to be 76 percent E2 and 24 percent M1. The interference phases of the E2 and M1 matrices of both transitions are the same in Lloyd's notation. The angular correlation studies and the conversion coefficient measurements indicate the orbitals of the levels of Tl^{203} to be d$_{3/2}$, d$_{3/2}$, and s$_{1/2}$, in order of decreasing excitation energy. The spin of the ground state of Pb^{203} is shown to be $\frac{5}{2}(-)$. (auth)

5035

NEW NEUTRON-DEFICIENT ISOTOPE OF SILVER. B. C. Haldar and Edwin O. Wiig (Univ. of Rochester, Rochester, N. Y.). Phys. Rev. 94, 1713-15(1954) June 15.

Ag^{103} of 1.1-hour half life, produced by bombarding silver with high-energy protons, was identified by following the decay with β-proportional, scintillation, and x-ray proportional counters and by milking the daughter, 17-day Pd^{103}, through seven half lives. Measurements with a β-ray survey spectrometer showed the presence of conversion electrons of 0.6-Mev energy and positrons of 1.3-Mev maximum energy, both of which decayed with a half life of 1.1 hours. Aluminum absorption measurements also gave 1.3 Mev as the maximum β⁺ energy. Ag^{103} decays in part by K capture. (auth)

5036

GROUND STATE OF Al^{26}. J. C. Kluyver, C. Van der Leun, and P. M. Endt (Physisch Laboratorium der Rijksuniversiteit Utrecht, Netherlands). Phys. Rev. 94, 1795(1954) June 15.

The Mg^{25}(p, γ)Al^{26} reaction is used to study the nuclear properties of the ground state of Al^{26}. Experimental data indicate that this ground state is T = 0 and that the level at 0.46 Mev is T = 1. Assuming a ground state spin of 5⁺, decay by a second forbidden β⁺ transition to the 1.83 Mev level of Mg^{26} is probable, with a endpoint of 1.11 ± 0.08 Mev. Taking log ft = 13.0 leads to an estimated half life of 4×10^4 yr. (K.S.)

5037

ELECTRON CAPTURE CROSS SECTIONS. Harry Schiff (McGill Univ., Montreal, Quebec, Canada). Can. J. Phys. 32, 393-405(1954) June.

Electron capture cross sections are calculated in the first Born approximation for alpha particles passing through hydrogen and singly charged helium ions passing through helium, using the complete interaction Hamiltonian. Estimations of captures into excited states are made with the help of the partial cross sections obtained in a simple closed form, using only the (incident ion)−(electron) interaction. The results indicate that the first Born approximation, using the complete interaction, is quite adequate in the velocity range given by $e^2/\hbar v \lesssim 1$. An impact parameter calculation for protons in hydrogen shows that the cross section obtained using only the (incident ion)−(electron) interaction gives unphysical results at low velocities ($e^2/\hbar v \sim 1$), and that most of the contribution to the cross section arises from impact parameters $p > \alpha_0$, where α_0 is the radius of the first Bohr orbit in hydrogen. (auth)

NUCLEAR TRANSFORMATION

5038

Radiation Lab., Univ. of Calif., Berkeley
TANTALUM SPALLATION AND FISSION INDUCED BY 340 MEV PROTONS (thesis). Walter Edward Nervik. Apr. 7, 1954. Contract W-7405-eng-48. (UCRL-2542)

Tantalum metal was irradiated with 340-Mev protons in the 184-inch cyclotron. Nuclides formed as spallation and fission products during the bombardments were separated chemically, identified, and their formation cross sections calculated. A very broad fission peak which extended from mass 20 to mass 132 was observed. The maximum fission yield occurred in the region of the nuclide Kr^{89} and analysis of a set of contour curves fitted to the data indicated that either Hf^{166} or Lu^{166} was "the most probable fissioning nucleus." The total cross section for fission was estimated to be 4.1 mb. Comparison of the fission data of tantalum with that of uranium and bismuth under the same bombardment conditions indicated that asymmetric fission was much more probable in tantalum than in either of the other elements. In the spallation region it was observed that neutron

emission was the predominant spallation reaction. Integration under the spallation yield curve indicated that of those tantalum target nuclei which received at least enough excitation energy to reach the region of "the most probable fissioning nucleus" less than 1 percent underwent fission; the remainder emitted spallation fragments. (auth)

5039

CROSS SECTION FOR THE REACTION $Al^{27}(\gamma, n)Al^{26}$. R. N. H. Haslam, W. N. Roberts, and D. S. Robb (Univ. of Saskatchewan, Saskatoon, Canada). Can. J. Phys. **32**, 361-4 (1954) June.

The cross section for the reaction $Al^{27}(\gamma, n)Al^{26}$ has been remeasured by the determination of Al^{26} activity. The results are in agreement with an earlier value obtained by the activity method, but differ from the result obtained by neutron detection. The discrepancy is thought to be due to complexity in the Al^{26} decay scheme. The reaction threshold is measured as 13.4 ± 0.2 Mev, the maximum energy of positrons from Al^{26} is 3.2 ± 0.1 Mev, and the half life is determined as 6.5 ± 0.1 sec. (auth)

5040

STUDY OF THE $C^{13}(n,\alpha)Be^{10}$ REACTION BY A SCINTILLATION COUNTER. Pierre Savel and Maurice E. Nahmias. Compt. rend. **238**, 2155-6(1954) May 31. (In French).

The direct observation of α particles confirms the reaction $C^{13}(n,\alpha) Be^{10}$. The lower limit of the cross section was found to be 1.4×10^{-27} cm^2. (tr-auth)

PARTICLE ACCELERATORS

5041

Research Foundation, Ohio State Univ.
DEVELOPMENT OF THE MODIFIED OHIO STATE UNIVERSITY CYCLOTRON. FINAL REPORT. PART 2. H. J. Hausman. June 2, 1954. 8p. 9 illus. Contract AT(11-1)-158. (AECU-2907) (cf. AECU-2607.)

Modifications of the Ohio State University Cyclotron are described. (K.S.)

5042

Atomic Energy Research Establishment, Harwell, Berks (England)
AN ELECTRON GUN FOR USE IN A METRE-WAVE HIGH POWER TRIODE. I. A. D. Lewis, J. Dain, L. S. Holmes, and J. L. Craston. Mar. 9, 1954. 33p. (AERE-GP/M-168)

Preliminary work on the development of an electron gun for use in a meter-wave high-power triode is presented. An arrangement was evolved from the Pierce type of gun having a voltage amplification factor of 38 and a ratio of anode to grid currents of about 4 to 1 (for a grid made of copper) when the grid and anode potentials are equal. The effects of small departure in dimensions from the optimum design were observed, and several cathode geometries were tried out among other experiments. Some mechanical problems arising in the construction of the gun and a description of a cathode mounting arrangement are given. No unacceptable distortions were found to occur even after repeated heating and cooling of the system. (auth)

5043

High-Energy Physics Lab., W. W. Hansen Labs. of Physics, Stanford Univ.
THE STANFORD MARK II LINEAR ACCELERATOR. R. F. Post, N. S. Shiren, and K. L. Brown, May 1954. 17p. Sponsored by ONR and AEC under Contract N6onr-25116. (HEPL-11)

The development of the Mark II electron linear accelerator is described. Primarily intended to provide an intermediate milepost on the way toward the eventual construction of a 1-bev machine, it was designed to be a prototype of one of the many sections of the larger machine. Electron energies up to nearly 40 Mev have been obtained, and peak

beam currents of about 10 ma in 1-µsec pulses. The theoretical design and experimental testing procedures developed in constructing the loaded waveguide are outlined. A brief description of the auxiliary equipment, including a multimegawatt klystron amplifier, is given. Operating characteristics of the accelerator are summarized. The machine has been in use since 1950 for experimentation in electron physics. (auth)

RADIATION ABSORPTION AND SCATTERING

5044

Kansas Univ. Graduate School
ENERGY ABSORPTION IN BONE (thesis). Bennie S. Friesen. Jan. 1954. 60p. Contract AT(11-1)-83-11. (AECU-2895)

The energy absorption in bone was determined using a thick-walled thimble ionization chamber, constructed of cortical bovine bone, by measurement of ionization in the air cavity of the chamber as the wall thickness was reduced. When Co^{60} gamma rays were used the energy absorption was found to be 105 ± 5 ergs/g/r. The lower limits to the energy absorption in bone irradiated with x rays were determined to be 157 ergs/g/r for 250 kv x rays filtered with a Thoreaus III filter, 273 ergs/g/r for 250 kv x rays filtered with 0.25 mm Cu + 1 mm Al, 300 ergs/g/r for 200 kv x rays filtered with 0.25 mm Cu + 1 mm Al, and 328 ergs/g/r for 140 kv x rays filtered with 0.25 mm Cu + 1 mm Al. The linear absorber thickness of bone through which maximum energy electrons produced by Co^{60} gamma rays are capable of passing was established at 1.25 mm or 0.248 g/cm^2. The effective atomic number of bone was determined to be 10. (auth)

5045

Nevis Cyclotron Labs., Columbia Univ.
ABSORPTION OF NEGATIVE PIONS IN DEUTERIUM: PARITY OF THE PION. W. Chinowsky and J. Steinberger. May 1954. 16p. Sponsored by ONR and AEC under Contract N6-ori-110, Task No. 1. (NEVIS-2; Cu-66-54-ONR-110-1-Phys.)

The reaction $\pi^- + D \rightarrow 2N$ was observed by detecting the two neutrons in coincidence with slow negative mesons incident on a liquid deuterium target. The observed angular correlation of the two neutrons confirms the identification of the process. The process is therefore not forbidden. This fact may be used to establish the odd relative parity of the pion and the nucleon. (auth)

5046

POINT SOURCE KERNEL FOR DIFFUSION WITH SMALL-ANGLE SCATTERING. W. E. Drummond and C. S. Gardner (Livermore Research Lab., California Research and Development Co., Livermore). Phys. Rev. **94**, 1491-6(1954) June 15.

Analytical expressions are derived for the particle flux from a point source which emits particles with an angular distribution $(1/\pi\beta) \exp[-\theta^2/\beta]$. The emission is into an infinite medium characterized by a strongly forward differential scattering cross section which can be approximated by a Gaussian $\Sigma(\theta) = (\Sigma/\pi\alpha) \exp[-\theta^2/\alpha]$, and in which all cross sections are energy independent. In particular, an asymptotic expression is obtained for large Σr, viz.

$$\phi(r,\theta) \sim \frac{\exp[-(\Sigma_t - \Sigma)r]}{\pi r^2(\beta + \frac{1}{3}\alpha\Sigma r)} \exp\left\{-\frac{\theta^2}{\beta + \frac{1}{3}\alpha\Sigma r}\right\}. \quad \text{(auth)}$$

5047

GAMMA RAYS FROM Cu DUE TO NEUTRON INELASTIC SCATTERING. L. A. Rayburn, D. L. Lafferty, and T. M. Hahn (Univ. of Kentucky, Lexington). Phys. Rev. **94**, 1641 (1954) June 15.

Monoenergetic neutrons from the $H^2(d,n)He^3$ reaction

were used to bombard a Cu scatterer in the form of a ring surrounding a gamma-ray spectrometer. An analysis of the gamma spectrum obtained by subtracting the background counting rate from the counting rate with the Cu scatterer in place yields gamma rays with energies of 0.965, 1.110, 1.67, 1.91, 2.42, and 2.58 Mev. (auth)

5048

SYSTEMATICS OF PHOTOPROTON REACTIONS. E. V. Weinstock and J. Halpern (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 94, 1651-4(1954) June 15.

The photoproton yields from the elements Ta, Pt, Pb, W, and Au have been determined for betatron bremsstrahlung bombardment at 22-Mev peak energy by the use of zinc sulfide detectors and a 40-μsec betatron pulse duration. The yields, as measured in photoprotons per mole per roentgen, are as follows: Ta, 5.7×10^4; Pt, 2.9×10^4, Pb, 5.8×10^4, W, 5.2×10^4; and Au, 1.9×10^4. These values, along with previous determinations, permit a study of general behavior of photoproton yields for all Z values throughout the periodic table. Comparisons with calculations based on the evaporation model show good agreement with experimental trends up to a Z of 50, after which the measured yields are to high by factors ranging from 10 to 10^4. Calculations based on the direct photoelectric process give better agreement. (auth)

5049

THEORY OF THE (d,p) REACTION. W. Tobocman (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 94, 1655-63 (1954) June 15.

The Born approximation treatment of the (d,p) reaction is modified so as to eliminate integrations over the interior of the target nucleus where the distortion of the incident wave is most severe. This treatment yields the S. T. Butler result when certain additional physical assumptions are made. An approximate expression for the (d,p) cross section is given in which (a) the Coulomb interaction is taken into account, (b) the effects due to the interaction of the deuterons and the protons with the target nucleus are expressed in terms of the boundary conditions for the wave functions of these particles at the nuclear surface, and (c) the effects arising from the fact that the mass of the target nucleus is not infinite are not entirely neglected. The methods presented can be used to get the corresponding result for the (d,n) reaction. (auth)

5050

PROTON-PROTON SCATTERING FROM 40 TO 95 MEV. U. E. Kruse, J. M. Teem, and N. F. Ramsey (Harvard Univ., Cambridge, Mass.). Phys. Rev. 94, 1795-6(1954) June 15.

Proton-proton scattering was studied from 40 to 90° in the c. m. system. The angular distribution was observed at 95 Mev. The experimental arrangement is described in detail. (K.S.)

5051

POLARIZATION BY p-p COLLISION AT 439 MEV. H. G. de Carvalho, E. Heiberg, J. Marshall, and L. Marshall (Inst. for Nuclear Studies, Univ. of Chicago). Phys. Rev. 94; 1796-7(1954) June 15.

The effect of triplet angular momentum states in p-p collisions is studied by an investigation of the p-p scattering assymmetry of 439-Mev polarized protons. A proton beam of 50% polarization was obtained from the Chicago cyclotron, and events with liquid H_2 were measured. The results at 439 Mev were little different from those at 310 and 340 Mev, previously reported. The angular distribution is more nearly $\sin \theta \cos \theta$ than at lower energies, and therefore a triplet p interaction is important. (K. S.)

5052

POLARIZATION OF ELASTICALLY SCATTERED NU-

CLEONS FROM NUCLEI IN THE BORN APPROXIMATION. Warren Heckrotte (Radiation Lab., Univ. of Calif., Berkeley) Phys. Rev. 94, 1797-8(1954) June 15.

It is shown that the Born approximation, which yields a qualitative estimate of the amount and character of polarization phenomena, is independent of the shape of the nuclear potential if the spin—orbit potential is taken to be proportional to the gradient of the central nuclear potential. (K.S.)

5053

COULOMB EFFECTS IN PION-PROTON SCATTERING AT RELATIVISTIC ENERGIES. Frank T. Solmitz (Inst. for Nuclear Studies, Univ. of Chicago). Phys. Rev. 94., 1799-1800(1954) June 15.

Previously reported methods for separating coulomb and nuclear effects in pion-nucleon scattering (Van Hove, Phys. Rev. 88, 1358 (1952)) at nonrelativistic energies are extended to relativistic ranges. (K.S.)

RADIATION EFFECTS

5054

Illinois Univ.

THE ROLE OF CRYSTAL STRUCTURE ON IRRADIATION EFFECTS ON METALS. D. Wruck and C. Wert. [1954] 26p. Contract [AT(11-1)-182]. (AECU-2906)

The resistivity of Fe has been determined to increase more than that of Co and Ni when these metals are bombarded at −150°C by 12-Mev deuterons. The same effect was observed for Fe and Ni by neutron irradiation at room temperature. This result may be interpreted as indicating that Fe is affected to a greater extent than either Co or Ni by heavy particle bombardment, though other interpretations may also be made. Annealing of the cyclotron-irradiated samples showed that a smaller fraction of the effect produced in Fe remained after a room temperature anneal than remained in Co and Ni. (auth)

5055

Atomic Energy Research Establishment, Harwell, Berks (England)

CHANGES IN SOME PHYSICAL PROPERTIES OF POLYETHYLENE BY PILE IRRADIATION AT 80°C. M. Ross. Apr. 2, 1954. 15p. (AERE-M/R-1401)

Changes are studied in the density, percentage of crystallinity, and Young's modulus of polyethylene due to pile irradiation of about 80°C. It is shown that increasing the temperature during irradiation makes possible the production of amorphous material after a shorter irradiation time, and a wide variety of materials of varying density and different mechanical properties can be made. A new method of estimating the density of amorphous material in ordinary (unirradiated) polyethylene is outlined. (auth)

5056

Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh RADIATION DAMAGE STUDY. EFFECTS OF IONIZING RADIATION ON CERTAIN MATERIALS. FINAL SUMMARIZING REPORT. Mar. 1954. 60p. Contract DA18-108-CML-3429. (NP-5218; ETF-760-366/Final)

The effects of radiation on silicone rubbers, silicone polymers, o-rings, refrigerants, chemical compounds, grease, and oils in order to determine their usefulness after exposure to high-intensity gamma-ray flux are reported. (auth)

5057

STORED ENERGY MEASUREMENTS IN IRRADIATED COPPER. Albert W. Overhauser. (Univ. of Illinois, Urbana). Phys. Rev. 94, 1555-7(1954) June.

Thin copper foils, cooled to liquid nitrogen temperature, were subjected to bombardment by 12-Mev deuterons.

The stored energy released due to annealing of the radiation damage was measured as the foils warmed to room temperature. Below $-40°C$ the stored energy released per °C was approximately uniform and is presumed to result from annihilation of closely spaced interstitial-vacancy pairs produced by the bombardment. A prominent maximum in the annealing spectrum occurred at $-15°C$ and is interpreted as binary recombination of interstitial diffusion. Changes in residual electrical resistivity were also measured. The stored energy to resistivity ratio was found to be 1.7 ± 0.2 cal/gram per micro-ohm-cm, both for the low-temperature processes and the $-15°C$ annealing peak. If the energy of formation of an interstitial-vacancy pair is 5 ev, a value of 11 micro-ohm-cm for the resistivity of one atomic percent of pairs is obtained. The atomic concentration of interstitial atomics and vacancies produced by an irradiation of 10^{17} deuterons/cm^2 at liquid nitrogen temperature is, accordingly, 5×10^{-5}. (auth)

RADIOACTIVITY

5058

Sloane Physics Lab., Yale Univ.
SARGENT DIAGRAM AND COMPARATIVE HALF-LIVES FOR ELECTRON CAPTURE TRANSITIONS. J. K. Major and L. C. Biedenharn. May 1954. 18p. Sponsored by Air Research and Development Command and AEC under Contract AF-18(600)-771. (OSR-TN-54-134)

Earlier studies by Thompson and Feather have been extended to lighter nuclei, wherever the half life, branching ratios, and transition energy $\underline{W}$ are known, and a Sargent diagram constructed for 87 electron capture transitions; $\underline{W}$, defined as the energy of the neutrino emitted during capture, must be deduced indirectly, from atomic mass differences, positron spectra, or inner bremsstrahlung. Known allowed transitions fall considerably below the line proposed by Feather, but the scatter of the points does not permit differentiation of Sargent curves for different degrees of forbiddeness. Comparative half lives have been calculated for these capture transitions, and are tabulated and compared with $\underline{ft}$ values for beta emitters. The distributions of $\underline{ft}$ values are similar, and agreement is evident between $\underline{ft}$ values for electron capture and positron emission in the same transformation. (auth)

5059

Radiation Lab., Univ. of Calif., Berkeley
INTERNAL CONVERSION OF GAMMA RADIATION IN THE L SUBSHELLS (thesis). Thomas Oliver Passell. Mar. 30, 1954. 104p. Contract W-7405-eng-48. (UCRL-2528)

Electron spectra from conversion of low-energy nuclear gamma radiation (up to around 350 kev) in several isotopes of the heavier elements have been investigated using a double-focusing beta spectrometer previously described. The following isotopes were studied: Am^{241}, Am^{242m}, Cm^{242}, Pa^{228}, Pa^{230}, Tl^{198m}, Np^{238}, and Np^{236}. Decay schemes, some tentative, have been proposed for some of the above nuclides. Miscellaneous data on the following isotopes, Pu^{241}, Pu^{240}, Pm^{150}, and Fr^{223}, are summarized. A twin-lens coincidence beta spectrometer, now in the assembly stage, is briefly described. Agreement of experimentally determined L conversion ratios with the most recent theoretical calculations were generally very good except for the electric dipole case, where about twice the expected $(L_I + L_{II})$ conversion was found. (auth)

5060

Radiation Lab., Univ. of Calif., Berkeley
ELECTRON CAPTURE STUDIES IN SHIELDED NUCLEI (thesis). Harold Jaffe. Apr. 5, 1954. 97p. Contract W-7405-eng-48. (UCRL-2537)

A search for electron capture in shielded nuclei has been undertaken using, in most cases, a 10-inch bent crystal spectrometer to detect the characteristic x rays. Electron-capture decay has been convirmed in Am^{242m}, Ir^{192}, Tl^{204}, and Np^{236} and detected for the first time in Am^{242} and Sb^{122}. Relative abundances have also been determined. Upper limits for this type of decay have been set in Np^{236}, Ag^{110m}, Ag^{110}, Cs^{134}, Tb^{160}, Tm^{170}, and Sb^{124}. Certain features of the gamma-ray spectra and decay schemes of several of the above nuclides have been studied. An apparent discrepancy in the gamma-ray spectrum of Am^{241} has been resolved, and several new transitions have been observed. A reported anomaly in the L x-ray energies of uranium has been shown to be due to an instrumental effect. (auth)

5061

SEARCH FOR A POSSIBLE ERROR IN THE MEASURED HALF LIFE OF Au^{198}. R. E. Bell and L. Yaffe (McGill Univ., Montreal, Quebec, Canada). Can. J. Phys. 32, 416-18(1954) June.

The half life of Au^{198} has been measured using a quartz fiber electroscope, with extreme precautions against errors due to the presence of Au^{199} in the source. The result obtained, 2.699 ± 0.003 days, shows that other recent determinations of the Au^{198} half life do not suffer an appreciable error from this cause. (auth)

5062

$\beta-\gamma$ ANGULAR CORRELATION OF Tm^{170}. Jun-ichi Fujita, Masato Morita, and Masami Yamada (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 11, 219-23(1954) Feb.

The $\beta-\gamma$ angular correlation of Tm^{170} is investigated, taking into account the Coulomb field. Both the $\beta-\gamma$ angular correlation and β-ray spectrum can be explained by the linear combination of the first forbidden nuclear matrix elements $\mathscr{M}(\beta r)$, $\mathscr{M}(\beta\alpha)$ and $\mathscr{M}(\beta\sigma \times r)$ in ST* type interaction of the Fermi theory of β-decay, and it is concluded that the changes of the spin and parity in the successive transitions of $Tm^{170} \rightarrow Yb^{170*} \rightarrow Yb^{170}$ are $1(-)-2(+)-0(+)$. (auth)

5063

SEARCH FOR ANOMALOUS POSITIVELY CHARGED PARTICLES FROM P^{32}. G. W. McClure (The Franklin Inst., Swarthmore, Penna.). Phys. Rev. 94, 1637-40(1954) June 15.

With a small β-ray spectrometer of unique design, the electrically charged emanations of radioactive P^{32} have been analyzed in an attempt to verify evidence found by others of the emission of positively charged particles in concentrations of the order of 10^{-3} to 10^{-4} per β decay. The ratio of the yield of positively charged particles to that of negatively charged particles in the momentum interval $H_\rho = 700$ to 2700 gauss cm was found to be less than 8×10^{-6}. This ratio is about 100 times smaller than earlier determinations in the same momentum interval obtained with cloud chambers and small spectrometers, but agrees in order of magnitude with a previous result obtained with an ordinary-sized spectrometer. The hypothesis that the anomalous "positive particles" in question are unstable and detectable only at short distances from the source would account for low positive-particle yield measured with an ordinary spectrometer but cannot account for the disparity between the present results and those arrived at repeatedly with cloud chambers and other "short path length" detectors. It appears that the previously reported "positive particle" ratios in the range 10^{-3} to 10^{-4} arise from spurious background effects. (auth)

5064

STUDY OF THE ISOBARIC TRIPLET Mg^{28}-Al^{28}-Si^{28}. Raymond K. Sheline and Noah R. Johnson (Florida State Univ., Tallahassee) and P. R. Bell, R. C. Davis, and F. K. McGowan (Oak Ridge National Lab., Tenn.) Phys. Rev. 94, 1642-51 (1954) June 15.

The nuclide Mg^{28} has been produced by betatron irradiation and cyclotron bombardments in the following reactions: $Si^{30}(\gamma, 2p)Mg^{28}$ and $Mg^{26}(\alpha, 2p)Mg^{28}$. It is a 21.3 ± 0.2 hour β^- emitter ($E_{max} = 0.418 \pm 0.01$ Mev, log ft = 4.30). Mg^{28} decays to Al^{28} with which it is in secular equilibrium. Milking experiments indicate that the Al^{28} daughter has a 2.3-min half life, and confirm the mass assignment of Mg^{28}. Gamma-ray spectra of the $Mg^{28} - Al^{28}$ secular equilibrium mixture indicate gamma rays of the following energies in Mev (intensities in parentheses): 1.769 ± 0.01 (0.98), 1.346 ± 0.01 (0.70), 0.949 ± 0.01 (0.29), 0.400 ± 0.01 (0.31), 0.0319 ± 0.001 (0.96). The 1.769-Mev gamma results from the decay of Al^{28}. Coincidence measurements show that the 1.346-, the 0.949-, and the 0.400-Mev gammas are each in coincidence with the 0.0319-Mev gamma, and that the 0.949- and 0.400-Mev gammas are in coincidence with each other. Delay coincidence measurements between the 1.346-Mev gamma and the 0.0319-Mev gamma indicate that the half life of the latter is $< 2 \times 10^{-9}$ sec. This information together with a $\alpha^K{}_{exp} = 0.032 \pm 0.066$ indicates that the 0.0319-Mev gamma is an M1 transition as predicted if the ground-state doublet of Al^{28} is a j—j doublet. A complete decay scheme for the isobaric triplet, $Mg^{28} - Al^{28} - Si^{28}$, is proposed. All spins and parities of ground and excited states are assigned. Assuming a mass of 27.985818 ± 0.000043 amu for Si^{28}, the mass of Al^{28} is 27.990809 ± 0.000045 and the mass of Mg^{28} is 27.992738 ± 0.000047. On the basis of an empirical scheme of nuclear systematics the energy available for decay and the half lives of the following nuclei are discussed: Si^{32}, Ne^{24}, O^{20}. A test for j—j doublets is proposed. This test indicates that the ground state doublets of Al^{28} and P^{32} are true j—j doublets, whereas the first excited state doublet of Al^{28} is not. (auth)

5065

DOUBLE VACANCIES IN THE K SHELL ASSOCIATED WITH K-ELECTRON CAPTURE IN A^{37}. J. A. Miskel and M. L. Perlman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 94, 1683-7(1954) June 15.

The pulse-height spectrum produced by the decay of A^{37} in a proportional counter was analyzed to determine the probability, per K-electron capture, for the production of a double vacancy in the K shell. The double vacancy is produced by promotion of the second K electron to a bound state or to the continuum. In these experiments both processes could be observed; the measurements included events in which the kinetic energies of the promoted electrons were in the range zero to 4.0 kev. Seventy-three percent of the theoretically predicted total effect should occur in this energy interval. The data, appropriately corrected, give for the probability of double K-vacancy production per K capture, in the energy interval investigated, $3.9 \pm 0.7 \times 10^{-4}$. The result is substantially in agreement with the value calculated from theory. (auth)

5066

BETA-DECAY INTERACTION. Henry Brysk (Vanderbilt Univ., Nashville, Tenn.). Phys. Rev. 94, 1794-5(1954) June 15.

Some consequences of recent re-examinations of β decay theory are discussed in connection with the mathematical formulation of interactions. Pseudoscalar contributions are particularly discussed, and it is concluded that this process does not play a detectable role in β decay, if present at all. (K.S.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

5067

Mound Lab.
NEUTRON EMISSION FROM ACTINIUM FLUORIDE. K. W. Foster and J. G. Stites. Apr. 21, 1953. Decl. May 12, 1954. 10p. Contract AT-33-1-GEN-54. (MLM-839)

Since one of the methods of preparing Ac involves reducing AcF_3 with Li, it is desirable to know how much F impurity can be tolerated in Ac in order that the neutron yield may be kept relatively low. The neutron yield was calculated for Ac alphas in a thick target of AcF_3 and was found to reach a maximum of 1.07×10^6 n/sec/c Ac^{227} in approximately 180 days. A sample of AcF_3 weighing 0.77 mg and corresponding to 0.044c of Ac was neutron-counted periodically over its growth period. The sample reached a maximum count of 5.34×10^4 n/sec. Therefore, 1c of AcF_3 would develop a maximum emission rate of 1.21×10^6 n/sec. A 1c sample of Ac^{227} containing 0.2% F impurity would emit approximately 10^4 n/sec at its maximum point. A possible Ac purity assay by neutron counting is suggested. (auth)

SPECTROSCOPY

5068

Purdue Univ. Engineering Experiment Station
INVESTIGATION IN THE ELECTROMAGNETIC SPECTRUM FROM 10 TO 1000 MICRONS. Burton W. Randolph. Sept. 1, 1953. 16p. Contract DA 44-009-eng-1408, Report No. 2. (AD-21484)

Apparatus set up to measure the decay curves of infrared-stimulable and quenching-type phosphors is described. Preliminary results obtained from six kinds of phosphors are discussed. Stimulation at different locations in the one-micron wavelength region was observed in four cases. Quenching was not observed, with the same intensity of infrared radiation, for phosphors which were reported to be of the quenching type. (auth)

5069

Los Alamos Scientific Lab.
GAMMA RAY SPECTROMETRY. Ernest C. Anderson. [1954] 9p. Contract [W-7405-eng-36]. (AECU-2914)

5070

Atomic Energy Research Establishment, Harwell, Berks (England)
A SIMPLE INFRA-RED GRATING SPECTROMETER FOR USE IN ANALYSIS. J. Gaunt. Apr. 9, 1954. 18p. (AERE-C/R-1398)

A simple infrared grating spectrometer which can be built for a small cost was designed for use as an analytical tool. Details of the design and performance are described. The use of filters for cutting out overlapping spectral orders is discussed, and the transmission characteristics of some infrared transmitting filters are included. Examples of the application of this instrument to the routine analysis of heavy water are included. (auth)

5071

GENERALIZED RACAH COEFFICIENT AND ITS APPLICATIONS. Akito Arima, Hisashi Horie, and Yukito Tanable (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 11, 143-54(1954) Feb.

The generalized Racah coefficient, designated as the U coefficient, has been defined as the transformation function between two different coupling schemes in pairs of any four angular momenta, corresponding to the Racah coefficient defined as the transformation function between two different coupling schemes of any three angular momenta. Several simple properties of the U coefficient have been derived, and the method of tensor operators extended to more general problems. Transformation coefficients between LS- and jj-coupling schemes in a many particle system can be evaluated by making use of these coefficients. (auth)

THEORETICAL PHYSICS

5072

MASS SPECTRUM OF ELEMENTARY PARTICLES. I. EIGENVALUE PROBLEM IN SPACE-TIME. Hiroshi

Enatsu (Columbia Univ., New York). Progr. Theoret. Phys. (Japan) 11, 125-42(1954) Feb.

In order to avoid the divergent self-energies of quantum field theory and at the same time to get the mass spectrum of elementary particles, a new method is discussed. A generalized wave equation which contains a function of a time-like parameter and four variables in the space-like domain, is assumed. In the wave equation the self-energy of a particle is considered to be a self-potential which is dependent only on the space-like variables. An investigation is made of how the eigenvalue problem for the masses of elementary particles is set up, and is solved by assuming a simple potential form. It will be shown that a discrete mass spectrum is obtained for a negative self-potential under some approximations. (auth)

5073

AN INVARIANCE THEOREM FOR CROSS SECTIONS OF MESON-NUCLEON SCATTERING. Shigeo Minami (Osaka Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 213-18 (1954) Feb.

The determination of the values of phase shifts from experimental data for meson-nucleon scattering is considered. Even if an exact knowledge of the differential cross section for this process could be obtained, and, in analyzing this, take into account high orbital angular momenta of meson, it will be found that two equally possible sets of solutions exist as phase shifts. This ambiguity is of a fundamental character, has its origin in certain properties of the spherical harmonics and of the spin function, and apparently remains unnoticed in the numerical analysis of Fermi and Yang. (auth)

5074

ON A COVARIANT GENERALIZATION OF TAMM-DANCOFF APPROXIMATION FOR PION-NUCLEON SCATTERING. Kiyomi Itabashi (Tohoku Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 227-8(1954) Feb.

5075

RENORMALIZATION IN GENERALIZED TAMM-DANCOFF APPROXIMATION FOR PION-NUCLEON SCATTERING. Kiyomi Itabashi (Tohoku Univ., Japan). Progr. Theoret. Phys. (Japan) 11, 228-30(1954). Feb.

5076

RENORMALIZATION OF MESON THEORY WITH A FIXED EXTENDED SOURCE. Geoffrey F. Chew (Univ. of Illinois, Urbana). Phys. Rev. 94, 1748-54(1954) June 15.

It is shown that the procedures for mass and charge renormalization developed by Dyson, Ward, and others for a covariant local field theory can be applied in the static or fixed source approximation where the interaction is nonlocal. Reasons are given to show that, although charge renormalization is not necessary in this case because the theory is not divergent, it is nevertheless a very sensible procedure. (auth)

5077

INTERMEDIATE COUPLING METHOD FOR MESON-NUCLEON SCATTERING. T. D. Lee (Columbia Univ., New York.) and R. Christian (Los Alamos Scientific Lab., New Mexico). Phys. Rev. 94, 1760-7(1954) June 15.

It is shown that for the meson-nucleon scattering processes an intermediate-coupling method can be applied which joins smoothly the results obtained from the weak- and strong-coupling limits. The method is illustrated by a detained study of the charged scalar meson field with fixed nucleon. (auth)

5078

SOLUTIONS OF HEITLER'S INTEGRAL EQUATION BY ITERATION METHOD. S. N. Biswas (Indian Assoc. for the Cultivation of Science, Calcutta, India.). Phys. Rev. 94, 1767-72(1954) June 15. (cf. NSA 7-6157)

An iterative procedure analogous to Wagner's method for the numerical evaluation of the Fredholm integral equation on radiation damping. It has been applied to the scattering of mesons by nucleons. The solution for the scattering of π^+ mesons by neutrons agrees with that of Hsueh and Ma, and Goldberger. For the scattering of π^+ mesons by protons, the solution has been taken up to the first approximation; the energy dependence and the angular distribution of the scattering cross section are shown in the accompanying figures. (auth)

5079

SOME APPLICATIONS OF THE MASS OPERATOR IN QUANTUM ELECTRODYNAMICS. Roger G. Newton (Harvard Univ., Cambridge, Massachusetts). Phys. Rev. 94, 1773-89 (1954) June 15.

The one-photon mass operator is calculated explicitly up to the second order in the applied field, once for the purpose of taking matrix elements between states that satisfy the complete Dirac equation, and once for free-electron states. The former is manifestly gauge-invariant. The part linear in the applied field is also calculated for matrix elements, only one side of which satisfies the Dirac equation; it is seen, in application, to cancel precisely the non-gauge invariant part (for free electrons) of the second-order mass operator. A systematic procedure for carrying out the photon integration at the very beginning of the calculation is described and used. After the (nonperturbation) derivation of a cross-section formula in terms of the mass operator, the latter is used to rederive the integrated Klein-Nishina formula and also applied to the simple case of a constant field. The use of the mass operator technique for the calculation of inelastic cross sections is demonstrated and it is proved that, except for virtual processes induced by the radiation field (in contrast to the static field), the low-energy limit of the bremsstrahlung cross section is a multiple of the one for elastic scattering (to all orders). Finally, the lowest order radiative corrections to Coulomb scattering are rederived. (auth)

5080

ON THE PROGRAM OF A SYSTEMATIZATION OF PARTICLES AND INTERACTIONS. A. Pais (Inst. For Advanced Study, Princeton, N. J.). Proc. Natl. Acad. Sci. U. S. 40, 484-92(1954) June.

The author (Physica 19, 869(1953)) attempted to consider baryons (nucleons and hyperons) as various half-integer representations of the full 3-dimensional rotational group O(3). This and other attempts are based on an extension of the fundamental role of charge independence (CI) in π-nucleon interactions to a wider system of particles. If the symmetries and stability properties that do not seem to find a place in the present theoretical picture are manifestations of invariance properties with respect to a group G, it is natural to try and identify G with the CI-group of the π-nucleon system which may be considered as $O_1(3)$. This note attempts to extend the invariance of the strong π-nucleon interaction under the CI-group to the invariance of a strong meson-baryon interaction under the group G. (cf. Progr. Theoret. Phys. (Japan) 10, 457(1953)). (L.M.T.)

5081

ON THE NATURE OF THE TRANSCENDENTAL CURVES ASSOCIATED WITH THE RELATIVISTIC TRAJECTORIES OF CHARGED PARTICLES. Louis Gold (Massachusetts Inst. of Tech., Cambridge). J. Appl. Phys. 25, 691-7(1954) June.

A detailed examination of the relativistic trajectories in the intermediate high-energy range is made for charged particles in crossed magnetic and electric fields for generalized injection states with explicit solutions given in parametric form. The particle path relation is generally

formulated, but explicit calculation is offered for the zero velocity injection only. (auth)

TRACER APPLICATIONS

5082

Missouri Univ.

TECHNIQUES FOR HANDLING AND USING Ba^{140} AS A TRACER. John H. Affleck, Harold John, and Louis V. Holroyd. Oct. 15, 1953. 13p. Contract N7onr-292, T. O. 5, Technical Report No. 15. (AD-20350)

Some experiments on oxide-coated cathodes are described in which the radioisotope Ba^{140} was used as a tracer. An oxide cathode of BaO containing Ba^{140} was used as an evaporator in a tube which contained several movable receivers on which the evaporated BaO was deposited. The activity of the receivers indicated the amount of barium deposited. The present tube design permits making the activity measurements through a thin glass bubble window in the side of the tube. Using it the rate was measured at which "free" barium, produced at the cathode-base metal interface, diffuses to the surface and is evaporated to the anode. A technique of spraying radioactive $BaCO_3$ was developed in order to produce cathodes of normal coating weight and density containing appreciable Ba^{140} (0.25mc/g). These cathodes were operated under quiescent conditions for various periods of time. This activity is related to the interface thickness, and its rate of formation could be determined as a function of life. (auth)

URANIUM AND URANIUM COMPOUNDS

5083

Knolls Atomic Power Lab.

SPONTANEOUS FISSION RATE OF U-238. F. A. White and J. S. Sheffield. June 17, 1954. 9p. Contract W-31-109-Eng-52. (KAPL-1141)

The spontaneous fission rate of U^{238} has been measured and found to be 24.1 ± 1.1 fissions per gram-hour. This value checks earlier work by Chamberlain, Farwell, and Segré in which the measurement was made using samples of normal and enriched uranium. Their value was 24.0 ± 1.1 f/g-hr. In the present measurement, high purity U^{238} samples were used (10 parts per million U^{235}). Hence, the contribution of spontaneous fissions from U^{235} and U^{234} was virtually zero. Fissions induced in the U^{238} from cosmic-ray slow neutrons could also be neglected. Two samples were placed in identical fission counters. Sample "A" weighed 6.00 ± 0.015 mg, and 427 fissions were registered in 2948 hours. Sample "B" weighed 6.00 ± 0.015 mg, and 501 fissions were registered in 3472 hours. The usual precautions were employed to obtain a wide counter plateau and to eliminate the possibility of spurious counts. (auth)